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THESIS

BENEFITS, COSTS AND RISKS OF CONVERTING FROM MILITARY DESIGN SPECIFICATIONS TO COMMERCIAL PERFORMANCE STANDARDS AT A COMMERCIAL LABORATORY

by

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June 1999

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In February 1996, Major General George E. Friel, Commander, U.S. Army Chemical, Biological Defense Command (CBDCOM) signed the first four waivers under his reinvention authority. These waivers allowed contractor laboratories to operate under commercial performance standards in their work with small quantities of chemical agents.

Throughout the process of converting from detail specifications to performance specifications, performance parameters were measured. During the design of these performance metrics, there were no thoughts of recording the costs to each contractor laboratory while converting their plans and procedures. The business risks to the contractors were also not measured.

This thesis investigates the benefits, costs and risks of converting from detail specifications to performance standards in an environment of reinvention. Since reinvention and conversion to performance standards are major Department of Defense (DOD) thrusts, the investigation of related benefits, costs and risks is timely. The research includes a case study of one of the National Institutes involved in the conversion process. The Institute chosen is Midwest Research Institute (MRI) in Kansas City, Missouri.

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BENEFITS, COSTS AND RISKS OF CONVERTING FROM MILITARY DESIGN SPECIFICATIONS TO COMMERCIAL PERFORMANCE STANDARDS AT A COMMERCIAL LABORATORY

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ABSTRACT

In February 1996, Major General George E. Friel, Commander, U.S. Army Chemical, Biological Defense Command (CBDCOM) signed the first four waivers under his reinvention authority. These waivers allowed contractor laboratories to operate under commercial performance standards in their work with small quantities of chemical agents.

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I. INTRODUCTION

> "I hereby delegate to the Commanders or Directors of Army Reinvention Laboratories and Centers the authority to waive, subject to the limitations described below, any requirement contained in a Department of the Army regulation, instruction or policy." (Togo West, Secretary of the Army, 14 August 1995)

A. PURPOSE

The purpose of this research is to determine the costs and benefits to one of our National Institutes (Midwest Research Institute in Kansas City, Missouri) in transitioning from Army regulations (detail specifications) for chemical agent research, development, test and evaluation (RDTE) to consensus commercial performance standards. The research also seeks to identify the business risks to the institute and national security risks to the Army caused by the transition. The 1996 transition from Army regulations to commercial performance standards occurred as the result of a U.S. Army Chemical and Biological Command (CBDCOM) reinvention effort.

B. BACKGROUND

As a part of the CBDCOM reinvention effort to convert from Army requirements to commercial performance standards, measurements were established to track whether benefits actually accrued as a result of the conversion. Measurements for chemical safety, physical security, and personnel reliability were established as a baseline for 15 months prior to the reinvention effort. New measurements (using commercial performance

standards) began for 15 months beginning in October 1996. These measurements are discussed in detail in Chapter III.

Cost and benefit measurements were collected for the baseline period and test period to see if benefits accrued from the conversion from Army Regulations to commercial performance standards. However, there were no measurements of the costs involved in rewriting procedures and training employees as to the new procedures, which resulted from the conversion effort. Therefore, a cost-benefit analysis was not performed.

Although Army Headquarters personnel expressed their perception of risks due to the conversion to performance standards, MRI was never queried as to their business risks. It is essential to look at these risks for both the Army and MRI's laboratories. These risks are identified in Chapter III and analyzed in Chapter IV.

It is the intent of this research to identify the costs to MRI during their 120-day transition period between Army regulations and commercial performance standards. During this transition period, MRI needed to rewrite plans and procedures and train employees to the new plans and procedures. These transition costs will be measured against the benefits accrued to MRI as a result of the transition. It is also the intent of this research to identify and analyze the risks to the Army and MRI from converting from a known set of requirements to new performance standards.

C. RESEARCH QUESTIONS

- Primary: What are the benefits, costs and risks of performing chemical agent research at contractor laboratories when U.S. Army detail specifications are substituted with consensus performance standards?
- Supporting:
  - Prior to the reinvention effort to transition to commercial performance standards, what were the Army specified RDTE laboratory requirements?
  - What commercial practices are in use by contractors?
  - How do the Army requirements compare to the commercial practices developed?
  - What level of effort is required to convert from Army requirements to commercial standards?
  - What lessons are learned in the conversion process and how can they be generalized to inform other managers interested in converting to performance standards?

D. RESEARCH METHODOLOGY

This research is a case study of Midwest Research Institute (MRI), which is located in Kansas City, Missouri. Cost-benefit data are collected through a questionnaire (Appendix A) and interviews with MRI managers and staff personnel. Previous benefit data are collected from 1996 MRI reports, which were generated during the reinvention effort. Interviews are conducted with MRI top management to determine the business risks associated with the transition to commercial performance standards. And interviews are conducted with Army regulatory proponents to assess Army national security risks resulting from the reinvention effort.

A literature review of related hazardous materials reinvention efforts within the Department of Defense (DOD) and Department of Energy (DOE) is conducted. Also, a literature review and analysis of commercial practices, similar in scope to those required for work with inherently dangerous chemicals, are performed.

E. SCOPE OF RESEARCH

The scope of this research is limited to a case study of Midwest Research Institute (MRI) and their costs, benefits and risks from converting their plans and procedures to enable a transition from Army regulations to commercial performance standards. The research includes a background of MRI, a background of the Army requirements, current Department of Defense reinvention efforts with hazardous materials and current commercial practices with controlled substances and biological agents.

F. LIMTATIONS AND ASSUMPTIONS

This research is limited to a case study of one of the National Institutes, MRI, during the conversion from Army Regulations to consensus performance standards. The reinvention effort, which was launched in February 1996, involved six laboratories. The six participating laboratories were:

- Battelle Memorial Labs – Columbus Ohio
- Midwest Research Institute – Kansas City, Missouri
- Southern Research Institute – Birmingham, Alabama
- Illinois Institute of Technology Research Institute – Chicago, Illinois
- CALSPAN Industries – Buffalo, New York
- Geomet Industries – Gaithersburg, Maryland

Each of these laboratories (four not-for-profit and two for profit) were involved in the formation of the Guidebook of Performance Standards for Operation of a Chemical Agent Laboratory. The Guidebook was published as a joint effort of the six laboratories and representatives from organizations within the Army Materiel Command (AMC). The effort of developing the performance standards for commercial laboratories is discussed in Section C of Chapter II.

The effort to develop the Guidebook is not part of the cost-benefit analysis. Though MRI participated in the development of the Guidebook, the coordination and publication efforts were funded by the Army. The Guidebook was then delivered to MRI as a final product. Since most military specification to commercial standard conversions begin with a commercial standard, the development of the standard is not included as a cost impact. In essence, the cost-benefit analysis begins with the adoption of the Guidebook of Performance Standards (hereinafter referred to as the Guidebook) at MRI.

The research for this thesis is specific to Midwest Research Institute (MRI) in Kansas City, Missouri. Measurements of MRI's costs and benefits are the only measurements discussed. There are measurements of benefits for each of the six contractor laboratories for the reinvention effort. Those measurements are published as collective industry figures in correspondence from the Edgewood Research, Development and Engineering Center (hereinafter referred to as the Center) to the Chemical and Biological Defense Command (now the Soldier, Biological and Chemical Command) [Ref.1].

MRI is chosen for this case study due to its relative size and dedication to continuous improvement. Size is important in defining the complexity of plans and procedures. The number of pages of plans and procedures are proportional to the size of the laboratory. Small laboratories have relatively less complex plans and procedures. MRI is a midsize laboratory - smaller than Battelle, but larger than the others. MRI's workforce is stable and has been in the chemical agent research business since 1963. Their consistent history of work in the chemical agent arena for DOD and other government agencies was considered valuable in this research.

For the purpose of this research, hourly costs are based on the Center's Cost Analysis Division's average contractor hourly rates for management, professional, technical and administrative personnel. It is not the intent of this research to divulge hourly rates of individuals working at MRI. And those specific figures are not necessary to this research. Cost-benefit analyses could be performed with only efforts (hours) spent and saved. In order to keep proprietary information intact, it is deemed necessary to use government allowed average rates. Therefore, all hours reported by MRI are multiplied by these allowable government contract hourly rates. As long as the rates are consistent, the payoffs will be similar.

For this research, risks relate to business risks for MRI and perceived national security risks for the Army. The Chief Operating Officer at MRI has provided his assessment of business risks from converting from Army requirements to performance standards. Senior Army officials have expressed the Army's risks resulting from the same conversion.

G. ORGANIZATION OF THE THESIS

The thesis is divided into five chapters, beginning with this introduction. Chapter II provides a background of the participants in this research. The background includes a brief history of the National Institutes in the United States, Midwest Research Institute (MRI) and the Army's involvement in chemical agent research at commercial laboratories. The background also explains the process of research, drafting and publishing commercial performance standards for the commercial laboratory sector.

Chapter III presents the methodology of collecting data for this thesis and the data collected. The methodology includes the manner in which measurements were designed for the reinvention effort of substituting Army regulations with commercial performance standards. The measurements, which resulted from the reinvention effort at MRI, are then presented. Research into current industry standards for equally toxic materials is detailed and discussed as to their possible applications in managing chemical agents. Chapter III then lists the results of interviews with other individuals relating to similar reinvention efforts within the Departments of Defense and Energy. Interviews with MRI and Army individuals related to the risks of conversion to performance standards are detailed. Finally, Chapter III includes an analysis of the two processes – the process of managing a chemical agent laboratory using Army regulations and the process using the Guidebook of Performance Standards.

Chapter IV provides a cost-benefit analysis of the reinvention effort at MRI. The original reinvention effort looked only at the benefits after the conversion. It never

measured the costs of conversion, to include opportunity costs if any. This research measures all of the costs and relates them to future benefits – both quantitative and qualitative. Chapter IV also delineates the business risks to MRI to convert to performance standards. The risks to the Army resulting from changing the management process for laboratories handling toxic materials is also presented.

Chapter V summarizes the findings and draws conclusions and recommendations based on the findings. Ideas for continued research or new research are also presented.

II. BACKGROUND

A. THE NATIONAL INSTITUTES

In order to provide a basis for viewing the reinvention effort of converting military requirements to commercial performance standards, it is essential to review the players in the effort. This chapter starts with the history of the National Institutes – those regional institutes that have been established to provide applications to research and to provide jobs to their respective regions. The National Institutes have provided much to society in the way of invention and monetary contributions. This section proceeds from the first known institute to the institute used for this research, Midwest Research Institute (MRI) in Kansas City, Missouri.

1. The First Institute – The Mellon Institute of Industrial Research

Research in the United States prior to 1900 was not normally carried out for profit. Professors, working in a university setting, often chose an esoteric area of science to study with little regard for the practical application of their research. To work on a research project with the goal of creating a new and better product was considered an act of commercializing science. One of the few scientists to resist this trend was Dr. Robert Kennedy Duncan, a professor at the University of Kansas. Duncan believed that science and industry should have a closer relationship. Pursuing this theory, he convinced a laundering company in Boston, Massachusetts to fund a new program that would establish

an industrial fellowship at the University of Kansas. The fellowship of scientists would have at their disposal all of the university resources to solve industry problems. [Ref.2]

Duncan's work caught the attention of Andrew and Richard Mellon, in Pittsburgh. The Mellon brothers convinced Duncan to come to Pittsburgh in 1911 to establish a new department of industrial research at the University of Pittsburgh. In 1912, Duncan moved his operations from the University of Kansas to the University of Pittsburgh. [Ref. 2]

By 1913, the department of industrial research had proved to be such a success that permanent headquarters were erected on the campus of the University of Pittsburgh [Ref. 3]. In 1927, the Mellons incorporated this department of industrial research as the Mellon Institute of Industrial Research. The Mellon Institute was established as a not-for-profit and independent (of the University of Pittsburgh) research center [Ref. 3]. It was also established as a memorial to the brother's father [Ref. 4]. The Mellon Institute of Industrial Research thus became the first of the not-for-profit, independent, regional centers for industrial applied research that became known collectively as the National Institutes.

2. The Largest Institute - Battelle Memorial Institute

In 1929, Battelle Memorial Institute opened its doors. It was started in 1929 through the will of Gordon Battelle as a tribute to his family [Ref. 5]. In 1939, Battelle Memorial Institute accepted the first contract for research for the federal government. During World War II, Battelle assisted the government in the war effort and played a significant role in the Manhattan Project. By the end of the war, Battelle had gained a

national reputation for applied research [Ref. 2]. Today, Battelle has become the largest of the not-for-profit research institutes. Battelle currently employs nearly 8,600 people and has revenues approaching $1 billion [Ref. 5].

3. Other Institutes

The end of World War II brought on an increased interest in possibilities offered through research. In 1944, Southern Research Institute began operations in Birmingham, Alabama. Less than a year later, Cornell Aeronautical Laboratory in Buffalo, New York, and Midwest Research Institute in Kansas City, Missouri, began operations. In 1946, Southwest Research Institute in San Antonio, Texas, Stanford Research Institute in Palo Alto, California and Franklin Institute in Philadelphia, Pennsylvania began operations. [Ref. 2]

Some of these institutes were chartered for the express purpose of serving their specific region. In the Midwest, the mechanization of farming had vastly reduced the manpower requirements for the agricultural economy of the region. The work opportunities for the population became stagnant. Many of the youth were migrating to other regions in search of employment. As the business leaders in the Midwest sought to bring new business to the region, they became aware of the need for improved research capabilities. These leaders visited research facilities in all areas of the United States. Through these visits, they determined the need for strict not-for-profit facilities dedicated to serving and increasing career opportunities in their regions.

As Argonne, Oak Ridge and Pacific Northwest laboratories became known as the National Laboratories, the aforementioned institutes became collectively known as the National Institutes. Unlike the National Laboratories, which were linked primarily with the Department of Energy, the National Institutes served local industries as well as local, state and federal government agencies. The growth of each institute can be attributed to the integrity of research and generosity to their respective communities.

4. Midwest Research Institute

a. MRI's Charter

Midwest Research Institute (MRI) was incorporated under the laws of Missouri in 1944. It was incorporated as an independent, not-for-profit organization. The purposes for which MRI were chartered are:

- To define and solve problems related to mankind, its environment, and its institutions and social systems as well as the interactions among them through the use of our talents and capabilities in science and technology.
- To be an independent source of scientific information and technical assistance for the public and private sectors, to increase the understanding and cooperation between them, and to facilitate desirable changes in society.
- To promote science and technology, to apply our knowledge and the discoveries resulting from our work to the creation of innovative products and processes, and to assist in the industrial and economic development of the nation and the mid-continent region. [Ref.6]

b. MRI's First Department of Defense Contract

The first Department of Defense contract was awarded to MRI in November, 1945. The contract was for the "Survey and Scientific Analysis of Major Natural Resources in the Missouri River Valley". The U.S. Army Corps of Engineers, Kansas City District awarded this contract. [Ref.6]

c. MRI's First Chemical and Biological Agent Contracts

The first chemical agent research and development (R&D) contract was awarded to MRI in April 1963. The contract was for the "Development and Fabrication of an Expendable Bioelectrochemical Detector". The U.S. Army Edgewood Arsenal, Edgewood, Maryland awarded it. Shortly thereafter, in August 1966, the Navy, New York Purchasing Office, Brooklyn, New York, awarded a chemical R&D project to MRI entitled, "Development of a Shipboard CW Agent Alarm". [Ref.6]

The first biological toxin R&D contract was awarded to MRI in July, 1961. The contract was for the "Fundamental Laboratory Research Investigation for the Development of Submicron Dry BW Agents". The U.S. Army Chemical Corps Biological Labs, Ft. Detrick, Maryland awarded it. [Ref.6]

d. MRI's Growth

From an original staffing of 63 in 1945 in Kansas City, MRI has grown to 1200 worldwide in 1999 [Ref. 7]. Nearly as many employees are familiar with chemical agent research materials today as were originally employed in 1945. In addition to its laboratories in Kansas City, MRI has managed the National Renewable Energy Laboratory

in Golden, Colorado for more than twenty years. MRI now contributes more than $100,000 per year to the local community in cost shared research. [Ref. 8]

e. MRI's Record of Research with Hazardous Materials

MRI has research contracts with the following agencies and thus must follow the guidelines and requirements of these agencies: [Ref. 8]

- Food and Drug Administration
- Environmental Protection Agency
- Center for Disease Control
- Drug Enforcement Agency
- Department of Labor
- Department of Transportation
- National Institute of Health
- Nuclear Regulatory Commission
- Department of Defense
- Local Government Agencies

Due to MRI's extensive contract efforts with these government agencies, MRI has been required to provide classified document and physical security controls at its facilites. These controls are imperative for work with chemical agents, biotoxins, cancer research, drug research and nuclear energy research. In addition to meeting requirements for classified document storage, MRI has had some sort of intrusion detection within their laboratory facilities for more than thirty years and a mandatory corporate drug testing policy since September of 1989. MRI has established an exceptional record of no security incidents and no lost time accidents in more than 35 years of chemical agent and biotoxin research. This flawless 35-year record is attributed to MRI's dedication to safety and security. [Ref. 6]

B. ARMY INVOLVEMENT IN CONTRACTOR CHEMICAL RESEARCH

Now that the contract players have been introduced, it is necessary to introduce the military players. While MRI has been involved in chemical and biological research since the early 1960's, the Army has been involved in chemical research since the early 1900's. Rules and regulations established over the years for Army research labs were not introduced to the contractors until the 1980's. The history of regulatory growth and the Army's eventual management of the contractor laboratories (to include MRI) are discussed in this section.

1. Early Army Involvement in Chemical Research

Historical research depicts very early involvement of the Army in chemical weapons development. In fact, the American University Experimental Station was the Center of U.S. Army chemical warfare research, development, testing and training during World War I. American University allowed the Bureau of Mines to conduct early chemical warfare research on their property starting in the summer of 1917. In 1918, the Bureau of Mines work was transferred to the newly established Chemical Warfare Service and the personnel were assigned to the Research Division and the Medical Division. The Research Division was transferred to the U.S. Army Edgewood Arsenal in 1919. [Ref. 9]

2. Army Research Development, Test and Evaluation (RDT&E)

Most research, development and testing of chemical protection and detection systems was performed at government laboratories until the early 1960s. Testing of protection and detection systems, in concept exploration and research and development,

was performed in Army laboratories at Edgewood. Testing of completed products slotted for type classification was performed mostly at Army laboratories and test sites at Dugway Proving Ground in Utah. Production acceptance tests were performed at Army production acceptance labs at Edgewood. So testing of chemical items was kept within government (Army) control. This overriding philosophy of material assurance for the soldier by government labs remained in effect until Mine Safety Appliances, in Evans City, Pennsylvania began production acceptance sampling of charcoal canisters for chemical protective masks in 1960 [Ref. 10].

3. Growth of Contractor Involvement in Army Chemical Research

With the scale up of the military action in Vietnam in the early 1960s, all of the military services were looking for laboratory RDTE support for chemical protection and detection devices. The need for unique detection capabilities aboard ships and aircraft and protection capabilities of standard head protection and outerwear for ship and aircraft crews created requirements for laboratory space, equipment and facilities that could not be satisfied by existing Army laboratories. Thus began the rather small proliferation of private laboratories used for research, development, test, evaluation and production sampling of chemical protection materials and devices and chemical detection equipment. These laboratories reached a peak of nine laboratories in the early 1980s. They now number six.

4. The Army's Bailment Agreement

a. Complications Resulting from Working for Multiple Military Services

From the early 1960s to the early 1980s, the rules established to work with chemical agents at contractor laboratories came from the individual military services within the Department of Defense. The rules for working with chemical agents for contracts with the Air Force differed from the rules for contracts with the Navy which were different yet from those contracts with the Army. In fact, contractor laboratories worked under different rules often within the same laboratory – even within the same laboratory ventilation hood.

b. Control of Contractor Inventory by Contract

All of the chemical agents, shipped to contractor laboratories, came from what is now the Edgewood Area of Aberdeen Proving Ground. Chemical agents were packaged from previous research stocks and shipped to contractor laboratories using military transportation. Chemical agents were ordered to satisfy a particular contract. And so, if a contractor laboratory needed 500 milliliters to perform their RDTE for a Navy helmet under development, then the contractor would order 500 milliliters of chemical agents necessary for their evaluation from Edgewood. If less than 500 milliliters was required for the contractor evaluation, the remaining agents were destroyed. They could not be used for another contract. If more than 500 milliliters were required, an additional

order was forthcoming to Edgewood, even if the contractor had excess material from another contract.

c. Bailment Agreement Defined

The Merriam Webster's Collegiate Dictionary (Tenth Edition) defines bail as:

- To deliver personal property in trust to another for a special purpose for a limited period.

An example of a bailment agreement is the implicit agreement formed when one takes a watch to a jeweler. The owner of the watch gives the watch to the jeweler for the purpose of repair and expects to receive the watch back in good condition and in a reasonable period of time.

d. Easing the Inventory Burden

In 1984, in order to alleviate the waste of chemical agent material and transportation cost, Mr. Walt Majerle, the Surety Manager at Edgewood, instituted a Bailment Agreement with the larger contractor laboratories (Battelle, MRI and Southern Research). The original Bailment Agreement between the contractor laboratories and the Army (Edgewood) was a no-cost agreement that eased the chemical agent inventory burdens of the contractor. Since the chemical agent was government furnished material (GFM), the Bailment Agreement placed strict accountability requirements on the contractor in return for allowing the contractor to use chemical agents on hand for more than one contract [Ref.11].

In essence, the contractor could use chemical agents not needed for one contract on another contract. This also allowed earlier start up for new contracts if the necessary chemical agents were available in the contractor laboratory. However, the Bailment Agreement did not alleviate the plethora of military service requirements.

e. Growth of the Bailment Agreement

The Bailment Agreement matured throughout the 1980s into safety, security and accountability rules for operating a chemical agent laboratory for the Army. All Army contracts eventually cited the Edgewood Surety Office Bailment Agreement. Therefore, each contracting agency no longer had to specify requirements to operate a commercial laboratory. The requirements for operating the lab were in the Bailment Agreement. The Army contracting agency could then spend its time developing the technical requirements for its materials and equipment. This was a major step forward in Army contracting for chemical agent RDTE.

5. The Army as Executive Agent for Chemical and Biological Research

In May of 1985, DOD Directive 5160.5 designated the Department of the Army as Executive Agent for DOD Chemical Weapons and Chemical and Biological Defense Research Development and Acquisition (RDA) [Ref. 12]. In a series of memorandums originating from the Department of the Army and routed through the Army Materiel Command through the Army Armament, Munitions and Chemical Command and finally to the Chemical Research, Development and Engineering Center (now the Edgewood Biological and Chemical Center), the Army directed the Center to:

> execute, in accordance with DOD DIR 5160.5, the certification and support of contractor owned-contractor operated (COCO) facilities for Army Executive agency non-medical research, development and acquisition responsibilities [Ref. 13].

The official notification to the Center to execute this program and to develop an appropriate funding mechanism came on July 27, 1992.

Thus, in 1992, it became the responsibility of the Edgewood Research, Development and Engineering Center to manage a sufficient commercial laboratory base for all of DOD. Meanwhile, other government agencies, such as the Environmental Protection Agency and the Federal Bureau of Investigation, were contracting chemical agent analyses to these same contractor laboratories. Altogether, the Center supported nine commercial laboratories performing chemical agent RDTE in 1992.

6. Department of Defense (DOD) Chemical Agent Research Guidance

On September 8, 1982, DOD Directive 5210.65, Chemical Agent Security Program, was implemented. This DOD Directive replaced DOD Directive 5210.65, Single Manager for Conventional Ammunition, November 17, 1981. It became the principle Directive for establishing a chemical agent security program for all the Services of DOD. On October 15, 1986, this DOD Directive was updated to its current form. It delineates the policy and responsibilities for DOD's management of the chemical agent program.

a. DOD Storage Site Requirements

Enclosure 2 of DOD Directive 5210.65 specifies the minimum standards for protecting chemical agents. Its major headings are General Requirements, Personnel, Physical Security System, Entry and Access Control, Transportation and Research Quantities of Chemical Agents. The bulk of these standards relate to storage and transportation of chemical agents. The storage relates to storage sites where tons of chemical agents or munitions are stored. Enclosure 2 also delineates requirements for the storage of classified agents. Since chemical agents and munitions at storage sites are no longer classified, these requirements are no longer valid.

Paragraphs B.1.b. and B.1.c. (Applicability and Scope) of DOD Directive 5210.65 state:

> - Covers DOD Components that have custody or possession of chemical agents as components of weapon systems, in bulk form, or in binary chemical munitions loaded with both components.
> - Applies to all chemical agent storage facilities and agents in transit worldwide, in peacetime, to include forward deployed retail stocks under Commanders in Chief (CINCs) control." [Ref. 14]

The applicability and scope of DOD Directive 5210.65 clearly pertains to chemical weapon systems that are stored or in transit worldwide. Chemical agents as "components of weapons systems" are not chemical agents for research and development. And "chemical agent storage facilities" are not chemical agent laboratories for research and development. Storage facilities are those facilities that store "chemical agents as components of weapon systems, in bulk form or in binary chemical munitions loaded with

both components". This becomes more clear with Section F of Enclosure 2 of DOD Directive 5210.65.

b. DOD Chemical Agent Research Guidance

For this research, the relevant part of DOD Directive 5210.65 is found in Section F of Enclosure 2, which is entitled "Research Quantities of Chemical Agent". Section F provides requirements for research quantities of chemical agents. These requirements are listed below:

- Inventory and accountability procedures shall be established to ensure continuing control of research quantities.
- Research quantities shall be secured in secure containers, vaults, or strong rooms locked with built-in three-position combination locks or key operated padlocks with medium-security cylinders (MIL-P-43951) mounted on comparable hasps.
- Contractual arrangements or other agreements involving transfer of custody of research quantities from the Department of Defense to another federal department or agency or to the private sector shall include the storage requirements prescribed in subsection F.2., above. [Ref.14]

These three requirements are all that pertain to research quantities of chemical agents. They specify only minimal storage requirements at contractor laboratory facilities. The proponent of DOD Directive 5210.65 envisioned only securing research chemical agents with medium security locks and assuring accountability of research chemical agents. These three requirements are still in effect. DOD Directive 5210.65 has not been

updated since 1986. But these DOD requirements have little effect on the chemical agent research community since they have been superceded by Army chemical agent regulations.

7. Department of the Army Chemical Agent Regulations

Prior to the original publication of DOD Directive 5210.65, the Army addressed the security of research quantities of chemical agents in its own regulations. In Chapter 8, Section 8-3.b.(6) of Army Regulation AR-50-6-1, Nuclear and Chemical Weapons and Materiel Chemical Surety Program (U), 1 February 1979, the following requirements were established for Category V (research chemical surety material) when storage quantities were one liter or less:

- A Class 5 security container, or equivalent, may be substituted for structures.
- The Chemical Exclusion Area may be the walls of the room in which the containers are located.
- Entry to the Chemical Exclusion Area may be controlled by operating personnel. (instead of armed guards)
- Door locks may consist of a digital combination lock and a secondary lock.
- An emergency response team (ERT) . . . with a 5 minute response time may be used in lieu of (other) security forces.
- In addition, the installation must develop plans to support the ERT with immediate assistance. [Ref. 15]

Thus, by 1979, the Army requirements for use of chemical agents in RDTE were already more stringent than the 1986 DOD requirements. The 1979 Army requirements

addressed detail requirements for storage, entry control and emergency response. However, the scope of the 1979 version of AR-50-6-1 did not include contractor facilities.

8. Inclusion of Contractors in Army Chemical Regulations

The 1986 version of AR50-6, Nuclear and Chemical Weapons and Materiel Chemical Surety, included contractor requirements for the first time. These requirements were translated into contractual language in the Center's Bailment Agreement that was then renegotiated with all of the contractors performing chemical agent RDTE with the Army. Personnel reliability requirements were established and a much longer and detailed list of security requirements were established for Army contracts. These changes were implemented before the Center was given authority to set standards for all of DOD [Ref. 13].

From the early 1960's until this point in time, contractors were mostly responsible for securing chemical agents (including rudimentary intrusion detection systems) and accounting for them (similar to the requirements of the 1986 version of DOD Directive 5210.65). The 1986 version of AR50-6 began the proliferation of detail specifications invoked upon the contractor laboratories.

a. New Army Physical Security Requirements

Concurrently, the physical security requirements for the storage of chemical weapons, bulk chemical agent and research quantities of chemical agent were covered in a separate Army regulation that had its own proponency. The Army's physical security requirements were now included in Army Regulation, AR190-59 (Military Police

Chemical Agent Security Program). The chemical surety regulation, AR50-6, now referenced AR190-59 for chemical agent physical security requirements. This now allowed three separate Army agencies, the Army Safety Office, the Office of the Deputy Chief of Staff for Operations (ODCSOPS) and the U.S. Army Nuclear and Chemical Agency (USANCA), to have input into contractor laboratory requirements.

b. Standardization of Army Requirements

By 1986, the Army requirements for RDTE began to mirror the requirements for storage facilities. It became easier for the proponents of the regulations to borrow existing language from other sections of the same requirements or parallel sections from nuclear surety requirements. The Army mindset became one of standardization – that all requirements should be similar, whether they were directed to storage of tons of chemical weapons or storage of 40-milliliter vials of chemical agents in a laboratory facility.

By 1992, the requirements for chemical weapons storage sites and chemical agent RDTE were similar. The new AR 190-59 (Chemical Agent Security) included the requirements for armed guards at contractor facilities, force on force training for guards and electronic maps to instantly display the location of intruders in contractor laboratories – even those facilities which had only one laboratory room. These new versions were published at the same time the Center was given responsibility to manage the contractor program for chemical agent RDTE for all of DOD.

9. Criticism by the Department of the Army Inspector General

In 1991, the Department of the Army Inspector General (DAIG) performed a Chemical Materiel Evaluation (CME) of the contractor laboratory program. Their report criticized heavily the oversight of the contractor laboratory program by the Center. The biggest criticism was the inability of the Center to quickly implement changes in Army policy at contractor laboratory facilities. The DAIG felt that the Center should simply reference Army Regulations in the contractor's Bailment Agreement, thereby implementing changes with the stroke of a pen. Unfortunately, Army Regulations are not written in military contractual terms.

10. Applying Army Regulations to Commercial Contracts

There are no "shalls" in Army Regulations. And the use of acronyms and unique military terms, such as commander, makes little sense to the contractor base. Therefore, the Center had to rewrite the Army requirements into contract language before beginning the contract modification process. The overall rewrite and modification process takes up to four months before both parties review and sign a new Bailment Agreement. But the Army Regulation, AR 50-6, also required the Department of the Army proponent (Office of the Deputy Chief of Staff for Operations - ODSCOPS) to concur with the Bailment Agreement modifications prior to forwarding to the contractors for signature. It is not uncommon for the Army approval process to take more than a year.

11. Delays in Contract Modifications

At the time of the 1991 DAIG CME, the new 1 Oct 91 security requirements of AR 190-59 had not been contractually modified. The modifications had been written, but had not been approved by ODCSOPS. The 1992 CME report criticized both the Center and ODCSOPS for this delay. The report also specified a reinspection for mid 1993. This was about the same time that Tom Poteet became the Center's Surety Manager.

12. Impending Conflict

The criticism by the DAIG of the Center's management of chemical agent contracts caused ODCSOPS to force the application of Army regulations to these same contracts. This created conflict among the proponents, the Center and the commercial laboratories. As one of the oldest and most trusted commercial laboratories, MRI joined with other laboratories to protest the application of onerous Army requirements to commercial laboratories.

C. CURRENT ARMY REQUIREMENTS

In order to provide a better picture of the current Army regulation requirements for chemical agent research at contractor laboratory facilities, portions of these requirements have been included as appendices. It is not the intent of this research to delineate all of the Army requirements for contractor laboratories. Rather it is the intent to view the amount of detail, originally designed for the military, which has been passed on to the contractors.

Current Army requirements for disqualification factors under the Army's personnel reliability program can be found in Appendix B. These disqualification requirements are only a small portion of the overall Army requirements for a personnel reliability program at contractor laboratories. Disqualification requirements establish the outer boundaries for personnel who have access to chemical agents. These requirements include drug and alcohol use (to include preemployment), medical conditions, prescription drug use, mental conditions, arrest records, negligence in performance of duty, progressive illnesses, poor attitude and inability to wear personal protective equipment.

Current Army requirements for performing a vulnerability assessment at a contractor laboratory can be found in Appendix D. Performing a vulnerability assessment is just one small part of the overall Army physical security requirements at a contractor facility. Vulnerability assessments determine the possibility and probability of unauthorized access into a facility. Vulnerability assessments include the threat to the facility and the features of the facility that will preclude the occurrence of the threat.

Current Army requirements for safety are not included in this research both because of their length and because they have been replaced by the Guidebook of Performance Requirements for Operation of a Chemical Agent Laboratory. The Army Safety Office now refers to the Guidebook of Performance Standards in their Army regulation, AR 385-61.

D. PROCESS OF PERFORMANCE STANDARD CONVERSION

In June 1993, Tom Poteet became the Surety Manager for the Edgewood Research, Development and Engineering Center and immediately inherited a discontented chemical agent contractor laboratory community. Due to the 1 Oct 91 AR 190-59 revision and the push from the DAIG to implement all the requirements of this revision (to include armed guards and force-on-force training), the contractor community hired a lobbyist to present their issues to leaders at the Secretary of Defense and Army levels. They were refusing to sign any Bailment Agreement with the Center that called for armed guards due to additional costs (over $2 million/year for all contractors) and legality (armed guards are illegal in some states). This discontent eventually led to the development of commercial performance standards.

1. The Origin of the Contractor/Government Working Group

In 1991, the Center held a conference with the contractors. The conference was held for the purpose of disseminating information to the contractors. It was basically one-way communications – with various members of the Center standing before the contractor community and giving briefs as to current and future requirements. It was a good start for communications, but there was little sharing and few chances for the contractor community to voice issues.

a. Initial Working Group Efforts

Poteet visited all nine-contractor laboratories during the September-October, 1993 timeframe. During these visits, he expressed his interest in forming a

government/contractor working group. The purpose of the working group would be to work through the regulatory issues facing both the Center and the contractor laboratory community. All parties agreed that an initial working group meeting could be held at the Center in November 1993 in conjunction with a technical conference already scheduled.

b. First Working Group Meeting

The initial working group meeting, in November 1993, concentrated on gaining knowledge of the players and airing grievances. Representatives from all nine contractors attended. Representatives from the proponents also attended, with the exception of the physical security proponent. There were representatives from the Army Office of the Deputy Chief of Staff for Operations (ODCSOPS), the Army Materiel Command (AMC), the Army Chemical, Biological and Defense Command (CBDCOM), the Army Medical Research Command (also performed medical research with chemical agents at one of the Institutes) and the Center. All in all, there were thirty attendees at the first working group meeting. Tempers were allowed to flare at this introductory meeting. The contractors were allowed to voice their opinions and support their opinions with facts and cost data. The meeting concluded with the military attendee from ODCSOPS announcing he saw little chance for change.

The contractors were thankful for a chance to at least air their grievances. They expressed an interest to continue the dialogue at semiannual meetings at the Center which could be held during regularly scheduled conferences in the fall and spring of each year. The second working group meeting was scheduled for March 1994.

2. Need For Commercial Practices

At the 9 March 1994 working group meeting, Mr. Michael Parker delivered the opening address. Mr. Parker is the Executive Director, Deputy to the Commander and highest-ranking Senior Executive Service (SES) civilian of the Chemical, Biological Defense Command. Parker stressed the need to move towards commercial practices at commercial chemical agent laboratories. His address was a challenge to the working group. Though the military officers, representing ODCSOPS, did not agree with Parker's assessment, the commercial laboratory representatives expressed guarded enthusiasm. Since many of the representatives were retired military, they sensed ODCSOPS could easily suppress any hope for future improvements.

At the same 9 March 1994 working group meeting, Dr. Ray Bills, laboratory manager of the Battelle West Jefferson, Ohio labs (and retired Army Chemical Corps Colonel) addressed the working group concerning a shift in emphasis from physical security and personnel reliability to safety. There was no argument that safety of the workforce was the key interest for those managing chemical agent laboratories. The commercial laboratory managers were much more interested in putting money into assuring safety than in adding armed guards. All participants, except the military ODCSOPS representatives, agreed with Bills' assessment.

3. Commercial Standards Working Group

As a result of Parker's comments and Bills' presentation, the working group appointed a smaller group to staff a position paper of possible actions toward developing

commercial standards at commercial laboratory facilities. The smaller working group was formed with the following representatives:

- Dr. Ray Bills – Battelle, West Jefferson, Ohio
- Michael Moskal – CALSPAN, Buffalo, New York
- Jeffrey Kiley – ETG, Baltimore, Maryland
- Linda Rowley – Medical Research Development Command, Ft Dietrick, Maryland
- Tom Poteet – Edgewood Research, Development and Engineering Center, Edgewood, Maryland [Ref. 16]

Dr. Bills was elected team chief and led the discussions. After an all day meeting on April 12, 1994, the working group developed a position paper outlining the move from Army regulations to a guidebook of performance standards based on OSHA's Chemical Hygiene Plan (29 CFR 1910.1450) and the Drug Enforcement Agency's 21 CFR 1300 (Controlled Substances). It was felt that other commercial standards should be reviewed, but that concentration should be on OSHA for safety and Controlled Substances for physical security and personnel reliability. Knowing that the Army's ODCSOPS would be reluctant to approve commercial standards only, the working group proposed using portions of existing Army regulations to fill in gaps where necessary. [Ref. 17]

4. Commercial Standards Position Paper

Notes from the working group meeting were put into a position paper by Bills and Poteet and staffed to all members of the working group. The final position paper was approved in early May. The position paper was sent to Parker on 17 May 1994. Parker

requested Poteet to set up a meeting with him and Brigadier General Friel, Commander of CBDCOM, to go over the approach to develop a set of commercial standards applicable to chemical agent research. [Ref. 17]

The meeting with BG Friel, Parker, Poteet and Bills occurred on 14 June 1994. At the meeting, Poteet stressed the need for a guidebook similar to the biosafety guidebook published by the Center for Disease Control in Atlanta, Georgia [Ref. 18]. Friel and Parker gave Poteet the go ahead to begin the project to research and develop applicable commercial standards that would later be incorporated into a Guidebook of Performance Standards for operating commercial chemical agent laboratories. On 30 June 1994, Parker gave Poteet his approval in writing [Ref. 19]

5. The Guidebook of Performance Standards Contract Effort

The original implementation plan required the entire working group to take sections of the proposed guidebook – safety, physical security, personnel reliability and quality – and write new guidance. Each subgroup would staff their work within the whole working group. It became quickly evident that this plan was not going to work. All parties were busy and the effort was monumental. Poteet decided that if it were going to get done, the effort would have to be contracted out.

Poteet then went to the Chemical and Biological Defense Information Analysis Center (CBIAC), a contract effort to provide chemical and biological information exchange, managed by Battelle's Edgewood Office. The CBIAC mission is one of information searches, data generation and report writing. The initial effort needed to be

one of gathering information and putting it into a draft document for review by the working group. The verbal estimate to provide this research and write a comprehensive document was $100,000.

Unfortunately, there were insufficient funds available for this effort. Though Parker and BG Friel had given their approvals, no funds came with that approval. Poteet then met with Joe Vervier, SES and Technical Director for the Edgewood Research, Development and Engineering Center for his guidance. Vervier allowed Poteet to use available Center overhead funds since the effort would benefit many product lines and cross all service boundaries. With the needed funds, Poteet went to the CBIAC for a proposal. Since Battelle managed the CBIAC, Battelle submitted the initial proposal.

a. Battelle's Initial Proposal

On 15 June 1994, Battelle submitted a contract proposal to the Center. The contract proposal was for $107,560 and the efforts proposed were to:

- Collect and collate relevant safety, surety, health, and medical U.S. Army chemical surety material operations regulations and cross-reference them to existing OSHA, federal regulations, NIOSH guidelines, and other performance standards currently governing private industry.
- Compile all applicable guidelines, performance standards, and requirements into a standards guidebook for the safe and secure operation of RDTE contractor chemical surety material laboratories. [Ref. 20]

b. Contract Effort Divided into Phases

The Center did not have this amount of funds available, so the effort was divided into phases – Phase I and Phase II. The division of effort allowed the development of the Guidebook to be funded incrementally. The scope of Phase I was the collection of relevant regulations specified in number 1 (above). This phase also required an outline of a proposed guidebook. The scope of Phase II was the compilation of all standards into a Guidebook (as in number 2 above). Funds for Phase I were obligated to Battelle on 9 August 1994 for the amount of $72,829 [Ref. 21].

6. Guidebook of Performance Standards Draft

By September 1994, work was initiated on Phase I. Dr. Bills was appointed the project manager for the phase. He and his staff at West Jefferson, Ohio performed the research and developed an outline for the future Guidebook. The "Draft Outline of Proposed Guidebook of Performance Standards for Operation of a Commercial RDTE Surety Laboratory" was completed and sent to the Center on 12 April 1995 [Ref 22]. This draft outline included a comparison of current performance standards detailed in 21 CFR, Chapter II, Part 1300 (controlled substances), 29 CFR 1910.1450 (OSHA Standard on Occupational Exposure to Hazardous Chemicals in Laboratories). It also detailed specifications delineated in all of the Army regulations pertaining to safety (including medical requirements), physical security and personnel reliability.

The draft outline concluded that all Army regulations pertaining to safety should be retained and incorporated into a document which would parallel OSHA's Chemical

Hygiene Plan. Since contractors already had to prepare a Chemical Hygiene Plan for the Department of Labor, the Guidebook would specify Army requirements and OSHA requirements so that only one plan would be required for both the Army and the Department of Labor. Although the safety requirements for the commercial laboratories did not decrease, the number of safety plans did. The draft outline also called for the elimination of the current Army chemical surety and chemical agent physical security regulations and the adoption of the controlled substances (21 CFR, Chapter II, Part 1300) requirements that paralleled those regulations with modifications.

The draft outline was staffed with all members of the contractor/government working group. The consensus of the working group was that the initial product was good enough to continue development of the Guidebook. Although the commercial members of the working group were not sure how the Center was going to get the guidebook approved by the Army proponent for chemical agent regulations, they were excited about the possibility for change and the introduction of some common sense.

7. Phase II of the Guidebook Effort

Phase II of the guidebook effort was let to Battelle in June, 1995 for an additional $42,621 [Ref. 23]. Phase II included the preparation of a guidebook and included overall coordination with all members of the contractor/government working group. Dr. Bills again led the effort. Poteet was the government point of contact and was the contracting officer's technical representative (for both Phase I and Phase II).

a. Coordination Draft

Phase II produced several products. The first product completed was a coordination draft of the proposed guidebook of performance standards. This first coordination draft was published on September 6, 1995 [Ref. 24]. The coordination draft was staffed with all contractor laboratories and all Army agencies, including oversight, involved in management of the contractor program. Army agencies included were AMC in Alexandria Virginia and CBDCOM and ERDEC in Edgewood, Maryland. Battelle's West Jefferson workforce performed all staffing and coordination. A panel of Battelle employees and representatives of the Risk Management Division at the Center reviewed all comments.

b. Final Draft

Comments to the coordination draft were finalized and included in the second product of Phase II – Final Draft of the Guidebook of Performance Standards for Operation of an RDTE Chemical Surety Material (CSM) Laboratory [Ref. 25]. The final draft was published on January 19, 1996. The same process for the coordination draft was used for staffing the final draft. All comments were sent to Battelle and a panel incorporated those comments or responded back to the commenting lab or agency as to why the comments were not incorporated. Battelle kept a record of all decisions, which are now a matter of public record.

c. Final Guidebook of Performance Standards

The third product of Phase II was the final "Guidebook of Performance Standards for Operation of an RDTE CSM Laboratory" [Ref. 26]. The completed guidebook, published on March 8, 1996, included the following contents:

- Introduction
- Guidebook Policy
- Employee Reliability Program
- Chemical Hygiene Plan
- Security Requirements
- Quality Assurance/Quality Control
- Glossary of Terms
- Bibliography
- CSM Hazards and Effects
- Agent Chemicals and Physical Properties [Ref. 26]

8. Comparison of Guidebook to Army Specifications

The completed guidebook encompassed around 90 pages of material – to include quality guidelines based on ISO 9000. This compared to the previous Bailment Agreements, which included detailed Army specifications and were over 600 pages.

9. Implementation of the Guidebook of Performance Standards

During the effort to design performance standards for the operation of commercial laboratories performing chemical agent RDTE, there was a sense that, when the effort was completed, there would be no way to implement these standards. According to AR 50-6, (Nuclear and Chemical Surety) the Army proponent of the regulation has to approve all agreements between the Army and chemical agent contractor laboratories. And the

proponent had consistently informed the working group members that the Guidebook would not be approved.

However, on 14 August 1995, the Chemical and Biological Defense Command (CBDCOM) was established as a Reinvention Center by the Secretary of the Army. The Commanding General of CBDCOM, Major General George E. Friel, sent a message to his workforce pertaining to his waiver authority under the Reinvention Laboratory [Ref. 27]. It then became apparent that the Guidebook of Performance Standards would be implemented using the Reinvention Laboratory guidance from the Secretary of the Army.

a. Reinvention Waivers

On 2 February 1996, MG Friel signed the following reinvention waivers:

- CBD-96-001, Contractor Owned, Contractor Operated Security Requirements.
- CBD-96-002, Contractor Owned, Contractor Operated Chemical Personnel Reliability Requirements.
- CBD-96-003, Government Owned, Contractor Operated (GOCO) Chemical Personnel Reliability Requirements.
- CBD-96-004, Contractor Owned, Contractor Operated Safety program Requirements. [Ref. 28]

These reinvention waivers allowed the Guidebook of Performance Standards to the used by the contractor laboratory base. It also allowed the use of the Employee Reliability Program by contractors operating government laboratories at Edgewood (CBD-96-003).

b. New Bailment Agreements

With the published March 8, 1996 version of the Guidebook, the Center was able to negotiate new Bailment Agreements with all of the Institutes and for profit laboratories. New agreements, specifying the Guidebook instead of the Army regulations, were sent to all laboratories by the end of April, 1996. New agreements were signed by all of the contractors by July, 1996. The contractors were given 120 days to rewrite procedures and train their employees to the new procedures. By the end of November 1996, representatives from the Center began to visit the contractors to verify conformance to the Guidebook requirements.

c. MRI's New Bailment Agreement

MRI signed their new Bailment Agreement on 27 July 1996. This research focuses on the efforts required by MRI to rewrite their plans and procedures in compliance with the Guidebook of Performance Standards. The cost-benefit analysis of this research will focus on the 120 time frame between the end of July 1999 and the end of November 1999. It is within these 120 days that the MRI staff had to rewrite procedures and train their employees to these procedures.

10. Reinvention Measurements

As a part of the reinvention effort to convert from Army requirements to the Guidebook, measurements were established to track whether benefits actually accrued as a result of the Guidebook. Measurements for safety, physical security, personnel reliability and evaluation efforts (using the old Bailment Agreement) were established as a baseline

for the 15 months prior to the reinvention effort. New measurements (using the new Bailment Agreement) began for 15 months beginning in October 1996. These measurements are discussed in detail in Chapter III.

Measurements were collected for the baseline period and test period to see if benefits accrued from the conversion from Army regulations to the Guidebook of Performance Standards. However, there were no measurements of the costs involved in rewriting procedures and training employees as to the new procedures. And no cost-benefit analysis can be performed without these cost measurements.

Although Army headquarters personnel expressed their risks due to the conversion, the contractors were never queried as to their risks. It is essential to look at these risks for the Army and the contractor laboratories. As previously stated, it is the intent of this research to look at the costs to MRI during the 120-day transition period and at the risks to the Army and MRI to convert from a known set of requirements to new performance standards.

11. Risks of Conversion

During the design phase of the Guidebook of Performance Standards and the beginning of the waiver period, Department of Army personnel expressed their concerns about the risks of moving from Army regulations to commercial standards. Their protests were concentrated on the risk to national security. Their comments centered on the embarrassment to the Army if a security incident were to occur under the new guidance provided in the Guidebook.

There were many phone calls to the CBDCOM Reinvention Office and to MG Friel from ODCSOPS to attempt to overturn the reinvention effort; however, MG Friel had reinvention authority. The waivers to reinvent chemical agent research at contractor laboratories were MG Friel's first waivers and they had been briefed and approved by the Commanding General of AMC, General Wilson, and the Assistant Secretary of the Army for Research, Development and Acquisition (ASARDA), Mr. Gilbert Decker. MG Friel did not back down.

The contractors were concerned about the risks of using the Guidebook instead of Army regulations, but their concerns were different from those of the Army. Contractors were concerned that the Guidebook made chemical agent research at contractor laboratories much simpler and more efficient than the Army regulations. It would then be easier for other commercial laboratories to enter the business of chemical agent research. And the commercial laboratories might be held more responsible for an incident if they adhered to their owns procedures versus the detailed procedures laid out by the Army.

Neither the Army nor the contractor risks were documented during the reinvention efforts. It is,again, the intent of this research to document and analyze both the Army's and MRI's risks in converting from Army regulations to commercial performance standards.

E. SUMMARY

1. The Institutes

The National Institutes have been involved in research for industry since the first institute (Mellon Institute of Industrial Research and Special Studies) was formed at the University of Pittsburgh in 1913. Institutes were formed as not-for-profit businesses and dedicated to serving and providing job opportunities for their respective regions.

2. MRI

Midwest Research Institute (MRI) was incorporated in 1944. Its first Department of Defense contract was in 1945. Its first chemical research and development contract was in 1963. From 1963 till around 1987 (24 years), MRI worked under many DOD chemical agent contract requirements for research. These requirements (less safety) were essentially the same as those published in Department of Defense Directive 1910.65 (Chemical Agent Security Program) in 1986. There were no security incidents nor lost time accidents recorded at MRI during this 24- year period [Ref. 6].

3. Army Regulations

The 1986 version of Army Regulation 50-6 (Nuclear and Chemical Weapons and Materiel Chemical Surety) contained specific Army requirements for contractor laboratories for the first time. The requirements were detailed in nature and borrowed from similar requirements relating to the storage of chemical munitions and bulk (ton) containers. These requirements contained unique Army terms and were essentially standardized for Army storage facilities and laboratories and commercial laboratories.

During this transition to Army detailed specifications, contractor laboratories experienced a significant leap in chemical agent laboratory requirements and associated costs. For example, in 1987, the personnel reliability program began at the contractor laboratories. Also, in 1987, significant physical security requirements were added to contractor laboratories.

4. Bailment Agreements

In 1984, the Edgewood Research, Development and Engineering Center established Bailment Agreements with each Institute and each for profit laboratory. These agreements allowed contractors to use chemical agents, in their repository, for more than one contract. These Bailment Agreements included requirements for safety, physical security and accountability. The Bailment Agreements were in place as the Army requirements were applied to the contractor base. The Bailment Agreement thus became the contractual device to add Army requirements.

5. Contractor Resistance

Changes to Army Regulation 190-59 (Chemical Agent Security Program) in 1989 brought resistance to impending increases in Army requirements for the first time. The 1989 version of AR 190-59 required armed guards at contractor facilities. This was a requirement that was both expensive and illegal in some states.

The contractor laboratory base became increasingly agitated with the preponderance of new Army requirements in the early 1990's. They hired a lobbyist to plead their case at many Department of Defense and Department of the Army Offices.

And the contractor laboratory base informed the Center that they would not sign new Bailment Agreements that included illegal requirements. Armed guard requirements were rescinded effective with the 1994 version of AR 190-59; however, other requirements, which should have been military unique, remained.

6. The Department of the Army Inspector General

The Department of the Army Inspector General performed a Chemical Materiel Evaluation on the contractor base in 1991. This occurred during the same time frame in which the Center was given the responsibility to manage the contractor laboratory base by the Department of the Army. The Center was criticized for its lack of quick inclusion of new Army requirements into its Bailment Agreements.

7. The Contractor/Government Working Group

In June 1993, Tom Poteet transferred to the Center's Surety Office and established a contractor/government working group. The working group was established to address the issues facing both the contractors and the Center. The working group met for the first time in November, 1993.

8. Commercial Performance Standards Introduced

At the March 1994 working group meeting, the idea of designing commercial performance standards (those to which many of the Institutes already conformed) was broached. This idea led to a small working group position paper, meetings with the Commander and Deputy to the Commander of CBDCOM, and a contract effort for the

writing of a Guidebook of Performance Standards for chemical agent research at contractor laboratories.

9. Completion and Implementation of The Guidebook

The Guidebook of Performance Standards was completed on March 8, 1996 approximately six months after CBDCOM was approved as a Reinvention Lab by the Secretary of the Army. The Guidebook was then implemented under waivers signed by the Commander of CBDCOM on 2 February 1996.

10. New Bailment Agreements and Metrics

All parties signed new Bailment Agreements by July 1996. Baseline measurements were made for efforts required under Army requirements. Similar measurements were designed for efforts under the new Guidebook. These measurements were adequate to define the benefits of the transition. However, there were no measurements of the costs to rewrite plans and procedures related to the new Guidebook requirements for safety, physical security and personnel reliability. Also, cost data were not kept relating to training employees to the new procedures. This lack of cost data leads to an inability to properly perform a cost-benefit analysis.

11. Risks

Department of the Army Headquarters personnel continuously fought the reinvention effort. Their concerns center around national security issues. Significant efforts were expended by the Army regulation proponents to overturn the reinvention waivers. Although the waivers remained in force, contractors were never queried in

regard to their consensus of risks in transitioning from Army detail requirements to consensus performance standards.

12. Presentation of Data

The players have been introduced and the setting of reinvention to Guidebook performance standards is established. It is now necessary to describe the methodology for collecting data for the costs, benefits and risks associated with converting from Army regulations to commercial performance standards and to present these data. Chapter III explains the methodology and presents the data which will be analyzed in Chapter IV.

III. DATA PRESENTATION

This chapter presents the research data collected to:

- support the costs, benefits and risks of converting from Army regulations to commercial performance standards at Midwest Research Institute
- support the commercial standard chosen to replace the Army regulations
- reflect current reinvention efforts by other government agencies relating to hazardous materials hanling at contractor facilities

However, before the data are presented, it is necessary to look again at the focus of this research and the methodology with which the data are collected.

A. RESEARCH FOCUS

There are three main focuses to this research. The first focus is on the costs, benefits and risks of the reinvention effort to transition from Army regulations to commercial standards. The first focus relates to the primary research question. The second focus is on current industry standards for lethal materials that are subject to theft or terrorist threats. The third focus is on similar reinvention efforts at other government agencies dealing with hazardous materials at contractor sites. The second and third focuses relate to secondary research questions.

1. Costs of Effort to Change to Commercial Performance Standards

Traditionally, when an organization desires to change a process, it designs a way to measure the process before and after the change. In this manner, designers of the new process can see if the change has produced any benefits to the organization. Some process changes result in negative benefits. If the benefits are negative, the designers can

either revert to the old process or try another innovation. If the benefits are positive, then the new process is embraced – even if the payback is considered to be a long period of time (e.g., five years or more).

Normally there is no measurement of the effort required to implement the new process. There are costs associated with these efforts which include rewriting procedures and training employees to the new procedures. These costs are seldom measured. It is assumed that the benefits of the new process outweigh the costs of these conversion efforts.

It is the intent of this research to measure the costs of change at MRI, due to an Army reinvention effort, and relate those costs to the benefits of the change. The costs and benefit data for the case study at MRI are presented in this chapter. The cost-benefit analysis of these data are included in Chapter IV.

It is also the intent of this research to delineate and analyze the risks of converting from Army regulations to commercial performace standards as a result of the Army reinvention effort. The risks to both MRI and the Army are presented in this chapter and analyzed in Chapter IV.

2. Risks of Change

a. Military Specifications Used in Environmental Permits

In some cases there are monumental risks associated with substituting military specifications with commercial standards. Though the move from military specifications to commercial standards is prevalent in DOD today, it is not prevalent in

regard to hazardous materials. In some cases, military specifications are quoted in state or federal environmental permits for hazardous materials operations at military installations. The military specifications, in effect, detail operating procedures for handling, removal or destruction of hazardous materials and wastes. These specifications cannot be substituted once the state or federal agency issues the permit. If they are changed in any way, the permits are rescinded. These specifications remain in effect as long as there is a need for a permit.

b. Army Regulations Based on Commercial Standards

In the case of biological agent safety and security, the military regulation (AR 385-69) was derived from the commercial standard (32 CFR parts 626 and 627) which was derived from the *Biosafety in Microbiological and Biomedical Laboratories* guidelines [ref. 18]. Therefore, since the commercial standard existed first, the military (Army) used the commercial standard.

In this case, there is little or no risk in adopting a commercial standard for military use. The military is not seen as changing a regulation to a standard. There can be no criticism as to any reduction in military requirements. The military simply adopts what already exists in the commercial sector.

c. Changing to Commercial Standards

In the case of chemical agent safety and security, the military regulations preceded the commercial standards because the chemical agents are uniquely military in nature. Chemical agents have been in development, by the military, since World War I.

Moving from military (Army) regulations to commercial standards creates some risk. The Army could be criticized for the perceived reductions in the security posture at commercial laboratories. Criticism could be extreme if an accident or incident occurred at a contractor laboratory after a change. These risks, from both Army and contractor perspectives, are discussed in this chapter.

3. Current Industry Standards

The second focus of this research deals with current industry standards. William J. Perry, former Secretary of Defense, in his letter of 29 June 1994, stated:

> I have repeatedly stated that moving to greater use of performance and commercial specifications and standards is one of the most important actions that DOD must take to ensure we are able to meet our military, economic and policy objectives in the future. Moreover, the Vice President's National Performance Review recommends that agencies avoid government-unique requirements and rely more on the commercial marketplace. [Ref. 29]

This means, for military specifications and standards, there is now a new way of doing business. Use of military specifications or standards currently requires a waiver. This is partially due to the history of automatically quoting specifications and standards – even when they made no sense. But it is also due to the maturation of commercial practices.

Many commercial standards exist today (e.g., ISO 9000 series) that are equally as good as their military counterparts (e.g., MIL-Q-9858). However, commercial standards often follow the military standards. Because commercial standards are not readily

available, the military often develops its own standards. Now that commercial standards exist for many military operations, the criticism of using military standards becomes accentuated when the commercial sector, which already follows commercial practices, has to follow military practices. Therefore, adhering to both ISO 9000 and MIL-Q-9858 becomes a burden to the commercial sector.

But there are also many specifications and standards that are buried within military regulations. These regulations were originally designed for military installations and organizations. Many were designed with the safety of the military workforce and national security in mind. Since there were no commercial standards to copy, the regulations were built on the current military procedures at the time.

The data presented in this section include current commercial standards that exist for lethal and high theft materials. These standards include those for biological agents and controlled substances. It is noted that standards for nuclear weapons are not included in this research. Most nuclear materials are still classified (chemical and biological agents are not). Also, rules and procedures for handling nuclear materials are based in law. Therefore, this research does not include nuclear standards.

4. Current Reinvention Efforts

The third focus of this research is on current efforts to reinvent government. However, the focus is not on all government reinvention efforts. The focus is in regard to hazardous materials handling, especially at contractor facilities, and cost, benefit and risk

analyses during the transition from military requirements to commercial performance standards.

B. METHODOLOGY

The methodology used to collect the data, which are presented in this chapter and analyzed in Chapter IV, is discussed in this section. First, the methods and assumptions used to perform a cost-benefit analysis at MRI are discussed. This is followed by the method used to review current commercial performance standards that are similar in scope to the Army regulations for chemical agent safety and security. This is followed by the methods used to determine the benefits of the change from Army regulations to commercial performance standards. Finally, the methods used to gain information about similar efforts in the Departments of Defense and Energy are discussed.

1. MRI Cost Analysis

In order to assess the costs of converting from military regulations to commercial performance standards, one of the national institutes was chosen to provide an estimate. Midwest Research Institute (MRI) personnel were asked for the percent of hours spent (in relation to a 40-hour week) in writing new plans and procedures to comply with the new commercial performance standards. The data were gathered in order to ascertain the categories of direct labor needed to create required plans and procedures. Table 1 summarizes the categories of personnel and plans collected for this research. This table is filled in with MRI responses in Table 5 of this chapter.

Labor Categories	MRI Personnel	Percent of Time on Safety Plan	Percent of Time on Security Plan	Percent of Time on Personnel Reliability Plan
Managerial Personnel				
Professional Personnel				
Technical Personnel				
Administrative Personnel				

Table 1. Matrix of Data Requested from MRI.

a. Direct Labor Costs

Since it is not the intent of this research to detail the hourly rates of employees at MRI, average contractor rates are used. These rates are taken from the Cost Analysis Branch of the Army's Edgewood Chemical and Biological Center (ECBC), Edgewood, Maryland [Ref. 30]. Table 2 provides a summary of rates for direct labor. These rates are used for independent government estimates when reviewing contractor cost proposals. Actual rates used for independent estimates are provided for FY96 through FY99. Rates for FY00 and FY01 are based on escalation rates of 1.0150 and 1.0312 respectively. These escalation rates are multiplied by the FY99 direct labor rates.

Labor Categories	FY96	FY97	FY98	FY99	FY00	FY01
Program Manager	$38.64	$38.88	$37.25	$41.56	$42.18	$42.86
Senior Scientist	$33.26	$33.02	$34.59	$35.09	$35.62	$36.18
Scientist	$22.71	$22.72	$24.84	$25.57	$25.95	$26.37
Technician	$14.57	$14.69	$13.94	$14.65	$14.87	$15.11
Clerical	$12.59	$12.27	$13.60	$11.04	$11.20	$11.38

Table 2. Hourly Rates For Engineering Direct Labor Categories Per Fiscal Year.

b. Opportunity Costs

In addition to direct hourly costs to MRI of employees working on new plans to comply with commercial standards, there are opportunity costs to MRI associated with these same employees' efforts. As long as technicians, scientists and staff support are working on transition documents for MRI, they are not charged to overhead and profit bearing customer projects. While these employees work on projects, they accrue overhead, general and administrative (G&A) expense and profit. When these employees are not working on customer projects, overhead, G&A expense and profit are foregone. These foregone costs are opportunity costs and are summarized in Table 3. The percentage rates are also taken from the Cost Analysis Branch at ECBC [Ref. 30].

Opportunity Cost Category	**Percent**	**Explanation**
Overhead	85%	Percent of Engineering Direct Labor
General & Administrative Expense	9%	Percent of Total Direct Labor and Overhead
Profit/Fee	8%	Percent of Total Direct Labor, Overhead and G&A

Table 3. Opportunity Costs by Category.

For this research, opportunity costs are equal to the total direct labor costs times the overhead rate plus the total of direct labor and overhead times the G&A rate plus the total of direct labor, overhead and G&A times the profit rate. This should give an estimate of dollars lost as a result of MRI's efforts to rewrite plans and procedures and train employees to new procedures.

c. Correlation of MRI Questionnaire to Government Estimates

In order to correlate MRI's responses related to costs (Table 1) to the direct labor rates used for government independent estimating (Table 2), conversion assumptions have been applied. Table 4 summarizes these assumptions. The fit is not a perfect fit in that there are both senior scientists and scientists that make up MRI's professional staff. For this research, those scientists with doctorate degrees are considered as senior scientists and those with bachelor and master degrees are considered as scientists.

MRI Labor Categories	Government Direct Labor Categories
Managerial Personnel	Program Manager
Professional Personnel	Senior Scientists/Scientists
Technical Personnel	Technician
Administrative Personnel	Clerical

Table 4. MRI to Government Conversion of Labor Categories.

2. Review of Current Applicable Commercial Performance Standards

In order to better see the need for change from Army regulations to commercial performance standards, current commercial standards are reviewed. These standards include Biosafety in Microbiological and Biomedical Laboratories (32 CFR Parts 626 and 627) and Food and Drugs (Title 21, Chapter II, Part 1301). Portions of these standards, relating to security and personnel reliability, are discussed in Section C of this chapter.

In order to properly compare the requirements of Army Regulations 50-6 (Nuclear and Chemical Weapons and Materiel Chemical Surety) and 190-59 (Military Police Chemical Agent Security Program) with the Guidebook of Performance Standards, portions of these regulations and standards are reproduced in Appendices B through E.

The actual regulation language is limited to one Army specific requirement for personnel reliability and one for physical security. Its matching Guidebook performance standard is also included. The reader can assess the differences in detail.

3. Benefits of the Guidebook of Performance Standards

The benefits of using the Guidebook of Performance Standards are assessed from memorandums relating to the Guidebook reinvention effort and from answers to the questionnaire to MRI (Appendix A). These research instruments allow for both the traditional measurements of reinvention and more candid comments from MRI personnel concerning qualitative benefits. Measurements are used for the cost-benefit analysis; however, the qualitative benefits were never measured and are difficult to translate into costs.

4. Similar Efforts by Other Government Agencies

Finally, the reinvention community is queried as to similar efforts. Representatives from reinvention offices within the Army, Navy, Air Force and Department of Energy are asked whether they have records of similar reinvention efforts relating to hazardous materials. They are also asked if similar costs of conversion were ever collected from their contractors. Further queries are addressed to smaller reinvention offices within the departments when those offices were identified.

C. DATA PRESENTATION

1. MRI Transition Costs

The questionnaire sent to MRI requested percent of effort of four categories of personnel to write three new plans and associated procedures and train MRI staff in regard to these new plans and procedures. Using the matrix already presented as Table 1, a new matrix of the actual percent of work performed by specific MRI employees is presented as Table 5. This table delineates every employee who worked on any plan, procedure or training for a percentage of their time (or reviewed a plan or plans for an exact period of time) during the four-month transition period beginning the end of July 1996. [Ref. 6]

Labor Categories	MRI Personnel	Percent of Time on Safety Plan	Percent of Time on Security Plan	Percent of Time on Personnel Reliability Plan
Managerial Personnel	Dr. John Stanley	4 hours total	2 hours total	2 hours total
Professional Personnel	Dr. Parmett (physician)	-	-	4 hours total
	Dr. Patricia Swann	-	3 hours total	-
	James McHugh	8 hours total	-	4 hours total
	Hope Green	50%	-	-
	Chris Bailey	10%	-	-
Technical Personnel	Marion Wright	-	10%	-
Administrative Personnel	Andrea Washington	-	-	10%

Table 5. MRI Transition Efforts.

According to government estimate procedures, a work-month is considered 147 hours [Ref. 30]. Therefore, for a four-month effort, the number of possible hours of work for any one individual is 588 hours. Using this maximum figure and the percentages in Table 5, Marion Wright, MRI's Security Specialist, spent 58.8 hours to rewrite plans and procedures and to train MRI personnel. This same process of converting percent of work to actual hours spent leads to the following list of personnel and associated hours spent:

- Dr. John Stanley – 8 Hours
- Dr. Parmett – 8 Hours
- Dr. Patricia Swann – 3 Hours
- James McHugh – 12 Hours
- Hope Green – 294 Hours
- Chris Bailey – 58.8 Hours
- Marian Wright – 58.8 Hours
- Andrea Washington – 58.8 Hours

a. Direct Labor Costs

Using Table 2 (Hourly Rates for Engineering Direct Labor Categories), Table 4 (MRI to Government Labor Categories Conversion) and the list above, direct labor costs for the transition effort are calculated. These costs are summarized in Table 6.

The costs in Table 6 reflect the total direct labor costs of conversion from Army regulations to commercial performance standards during August to November 1996. But these costs are only a part of MRI's costs related to the transition from Army requirements to commercial performance standards. Since August to November 1996 includes two fiscal years, direct labor costs are divided equally between August and September of FY96 and October and November of FY97.

Labor Categories	MRI Personnel	Hours Spent During Transition	Direct Labor Rate (FY96)	Direct Labor Costs (FY96)	Direct Labor Rate (FY97)	Direct Labor Costs (FY97)
Managerial	Dr. Stanley	8 Hours	$38.64	$154.56	$38.88	$155.52
Professional	Dr. Parnett	8 Hours	$33.26	$133.04	$33.02	$132.08
	Dr. Swann	3 Hours	$33.26	$49.89	$33.02	$49.53
	McHugh	12 Hours	$22.71	$136.26	$22.72	$136.32
	Green	294 Hours	$22.71	$3338.37	$22.72	$3339.84
	Bailey	58.8 Hours	$22.71	$667.67	$22.72	$667.97
Technical	Wright	58.8 Hours	$14.57	$428.36	$14.69	$431.89
Admin	Washington	58.8 Hours	$12.59	$370.15	$12.27	$360.74
Totals		**497.4 Hours**		**$5278.30**		**$5273.89**

Table 6. MRI Costs of Conversion to Commercial Performance Standards.

b. Opportunity Costs

As stated previously in Section B of this chapter, MRI also incurred opportunity costs during this transition period. MRI's opportunity costs stem from not being able to charge employees, working on new internal procedures, to projects which generate overhead, general and administrative (G&A) and profit billings. Opportunity costs, for this research, are based on rates taken from the Cost Analysis Branch of the Army's Edgewood Chemical and Biological Center, Edgewood, Maryland [Ref. 30]. MRI opportunity costs (using direct labor costs in Table 6) are summarized in Table 7. The opportunity costs are based on a direct labor total (for FY96 and FY97) of $10,552.19.

Opportunity Cost Category	Method of Calculation	Costs
Overhead	85% of Direct Labor Costs .85 X $10,552.19	$8,969.36
G&A Expense	9% of (Direct Labor + Overhead) .09 X $19,283.59	$1,756.93
Profit	8% of (Direct Labor+Overhead+G&A) .08 X $21,019.11	$1,702.28
Total	**Overhead + G&A + Profit**	**$12,428.57**

Table 7. MRI Opportunity Costs of Conversion to Commercial Performance Standards.

c. Total Costs

Using the direct labor costs from Table 6 and the opportunity costs calculated in Table 7, the total costs for converting Army regulations to commercial performance standards are the sum of the direct costs and opportunity costs. These total costs are $10,552.19 plus $12,428.57, which equal $22,980.76. These total costs are used again in Chapter IV to perform the cost-benefit analysis.

2. Current Commercial Performance Standards

a. Biological Agent Standards

The materials that most closely approximate research quantities of chemical agents, in terms of lethality and terrorist threat, are biotoxins. Weapons of mass destruction include both chemical and biological weapons. The current industry standard for the safety and protection of biological agents is *Biosafety in Microbiological and Biomedical Laboratories* [Ref. 18]. This standard was established by the Center for Disease Control and Prevention and the National Institutes of Health.

The biological agent standard concentrates on the safety of those working in microbiological and biomedical laboratories. It stresses inoculations, training and due caution. The standard details the various types of agents (bacterial, viral, parasitic, and fungal) and specifies the level of protection for each. The levels of protection range from biosafety level 1 (least protection) to biosafety level 4 (most protection). One of the most famous examples of a level 4 arbovirus is the Ebola virus. Immunodeficiency viruses (such as the HIV virus) are considered under biosafety level 3. Bacillus anthracis (anthrax) and salmonella typhi (typhoid fever) are examples of bacterial agents that require biosafety level 3 practices and procedures.

(1) Biosafety Level 3 Security Requirements. The security requirements of the biosafety standard are far different from the Army requirements of AR 190-59. Physical security requirements for biosafety level 3 biotoxins are summarized as follows:

- Laboratory doors are kept closed when experiments are in progress.
- The laboratory director controls access to the laboratory and restricts access to persons whose presence is required for program or support purposes.
- The laboratory director establishes policies and procedures whereby only persons who have been advised of the potential biohazard, who meet any specific entry requirements (e.g., immunization), and who comply with all entry and exit procedures, enter the laboratory or animal rooms.

- When infectious materials or infected animals are present in the laboratory or containment module, a hazard warning sign, incorporating the universal biohazard symbol, is posted on all laboratory and animal room access doors.

- The laboratory is separated from areas that are open to unrestricted traffic flow within the building. Passage through the two sets of self-closing doors is the basic requirement for entry into the laboratory from access corridors or other contiguous areas.

- Windows in the laboratory are closed and sealed. [Ref. 18]

All other special practices and precautions related to biosafety level 3 pertain to safety requirements. A list of personal protection, immunization and ventilation requirements follow. Again, the emphasis of the biotoxin standard is safety of the workforce. Physical security requirements are simple, straightforward and emphasize control by the laboratory manager.

(2) Additional Biosafety Level 4 Security Requirements. Biosafety level 4 adds the requirement that access to the facility is limited by means of secure, locked doors. Locked doors are then required for the most deadly biotoxins known to mankind. [Ref. 18]

(3) Comparisons – Chemical and Biological. The physical security requirements for laboratories performing research with biotoxins are significantly different from those for laboratories performing research with minute quantities of chemical agent. Army Physical security requirements for chemical agents not only require closed windows, but require steel bars on the windows. The Army also requires

laboratories, performing research using chemical agents, to have intrusion detection systems (IDS) and to test the IDS using low crawling methods at very low speeds. Also required are dual locks on ventilation hoods (only one on a team can know a single combination), dual locks on entry doors and a myriad of entry control procedures. The laboratory manager has little leeway in providing direction. The Army requirements delineate the direction.

The biosafety guidelines do not require a personnel reliability program. There are no security clearances required since biotoxins are not classified (neither are chemical agents). There are no drug screening requirements – though most laboratories have a drug-screening program. And there are no disqualifying requirements other than immunization, training and a need to work with the biotoxin. The Army requires a very stringent personnel reliability program – to include National Agency Checks (NAC) every five years, a mandatory drug screening program and extensive disqualifying factors (to include mood swings).

Though biological agents are equally as lethal as chemical agents, the requirements for physical security and personnel reliability are nearly nonexistent for the former and formidable for the latter. One might even consider biological agents as more dangerous than chemical agents since biological agents can multiply while chemical agents eventually dissipate by evaporation, dilution or decontamination.

The microbiological and biomedical standard from the Centers for Disease Control and Prevention and National Institutes of Health is an excellent example of a performance standard. It has been codified as 32 CFR parts 626 and 627. But the standard is so far

removed from the requirements of the Army for research using chemical agents, that it is deemed inappropriate for use.

b. Controlled Substances Standards

Since there are insufficient physical security and personnel reliability requirements in the biosafety standard, another commercial standard is sought which might approach the intricacies of AR 50-6. The materials that most closely resemble the theft potential imagined by the Army proponent are controlled substances (drugs). These materials have a reputation for theft – thus strict standards have been promulgated by the Drug Enforcement Administration (DEA) under the Department of Justice. These standards are found in Title 21 – Food and Drugs, Chapter II – Drug Enforcement Administration, Part 1301. This document is also known as 21 CFR Ch. II 1301.

(1) Controlled Substances Security. Section 1301.71 (Security Requirements) of 21 CFR Ch II 1301 specifies the following physical security requirements:

- In evaluating the overall security system of a registrant or applicant, the Administrator may consider any of the following factors, as he may deem relevant to the need for strict compliance with security requirements:
  - The type of activity conducted.
  - The type and form of controlled substances handled (e.g., bulk liquids or dosage units, usable powders or unusable powders).
  - The quantity of controlled substances handled.

- The location of the premises and the relationship such location bears on security needs.
- The type of building construction comprising the facility and the general characteristics of the building or buildings.
- The type of vault, safe, and secure enclosures or other storage system used.
- The type of closures on vaults, safes and secure enclosures.
- The adequacy of key control systems and/or combination lock control systems.
- The adequacy of electric detection and alarm systems, if any including use of supervised transmittal lines and standby power sources.
- The extent of unsupervised public access to the facility.
- The adequacy of supervision over employees having access to manufacturing and storage areas.
- The procedures for handling business guests, visitors, maintenance personnel and nonemployee service personnel.
- The availability of local police protection or of the registrant's or applicant's security personnel.
- The adequacy of the registrant's or applicant's system for monitoring the receipt, manufacture, distribution and disposition of controlled substances. [Ref. 31]

These fourteen controlled substances requirements most closely resemble the hundreds of physical security requirements found in AR 190-59 (Military Police Chemical Agent Security Program). Section 1301.71 allows for the quantity of material stored, a vulnerability assessment of location, secure enclosures and locks, an intrusion detection system, handling of visitors and use of local police or corporate security. Since all of the

institutes (including MRI) already operate under 21 CFR Ch. II 1301 and the DEA document allows for many of the requirements of AR 190-59, Section 1301.71 became the basis for the commercial performance standard for physical security at contractor laboratories performing chemical agent research.

(2) Personnel Screening for Controlled Substances. Section 1301.76 (Other security controls for practitioners); section 1301.90 (Employee screening procedures) and section 1301.91 (Employee responsibility to report drug diversion) add the following personnel screening requirements:

- The registrant shall not employ, as an agent or employee who has access to controlled substances, any person who has been convicted of a felony offense relating to controlled substances . . . as a consequence of any federal or state administrative, civil or criminal action resulting from an investigation of an individual's handling of controlled substances.
- The registrant shall notify the Field Division Office of the Administration in his area of the theft or significant loss of any controlled substances upon discovery of such loss or theft.
- The following questions will become a part of an employee's screening:
  - Within the past five years, have you been convicted of a felony, or with the past two years, of any misdemeanor or are you presently formally charged with committing a criminal defense? If the answer is yes, furnish details of conviction, offense, location, date and sentence.
  - In the past three years, have you ever knowingly used any narcotics, amphetamines or barbiturates, other than those prescribed to you by a physician? If the answer is yes, furnish details.

- Reports of drug diversion by fellow employees is not only a necessary part of an overall employees security program but also serves the public interest. It is, therefore, the position of DEA that an employee who has knowledge of drug diversion from his employer by a fellow employee has an obligation to report such information to a responsible security official of the employer. [Ref. 31]

These DEA requirements add, in performance language, the need for personnel screening, personnel disqualification and continuous evaluation of personnel. These requirements are also required in AR 50-6, but in much more detail. Section 1301.93 (Sources of information for employee checks) adds the requirement of a local records check, and, if information is uncovered by the employee questionnaire or the local records check, a need to have the employee checked by a Division DEA Field Office. Again, because these standards are also in use by the institutes, they became the basis for the Guidebook Employee Reliability Program. [Ref. 31]

c. Choosing the Closest Commercial Standard to the Army Requirements

Of the two principle commercial standards for deadly and theft prone materials (biological agents and controlled substances), the controlled substances standard provided the best base for modification for chemical agents. This was a fairly straightforward decision since the biotoxin standard provides little in the way of physical security and no personnel reliability requirements while the controlled substances standard provides both.

d. Army Regulation for Arms, Ammunition and Explosives

It is interesting to note that there is another Army regulation that also applies similar physical security requirements and personnel reliability requirements to Army controlled weapons. This regulation is AR 190-11, Physical Security of Arms, Ammunition and Explosives. It deals with the use and storage of arms such as nonnuclear manportable missiles and rockets "in a ready to fire" configuration. Examples of these missiles and rockets are the Hamlet, Redeye, Stinger, Dragon and light antitank weapon (LAW). AR 190-11 is less stringent than AR50-6 – even though one might imagine a Stinger missile to be of significant terrorist value. AR 190-11 provides for a local records check of employees instead of the mandatory National Agency Check for chemical agents. In many instances, it more closely resembles the Guidebook of Performance Standards. It regulates offensive weapons that are very much in demand by terrorists and of major political embarrassment if stolen. But it is not a commercial standard. [Ref. 32]

3. Benefits of the Guidebook of Performance Standards

In order to look at all of the benefits to using the Guidebook of Performance Standards, instead of current Army regulations, both historical measurements and answers to MRI's questionnaire are used.

a. Historical Measurements during Waiver Period

The historical measurements were recorded both before and after the transition period of July to November 1996. There were baseline measurements for 15 months (five quarters) before the transition to commercial standards and new process

measurements for 12 months (four quarters) after the transition. Each contractor laboratory reported measurements of critical processes every three months until December 1997. The critical processes were chosen when the waiver period began. Since the measurements were chosen before beginning the new processes, the measurements for the baseline period were estimated based on the experience of those performing the processes.

Historical data are summarized in Table 8. These data include measurements for physical security, personnel reliability and safety. Since both the contractors and the government knew there would be no cost savings due to changes in the safety requirements (there was no effort to change safety requirements – only restructure them), there were no hours of effort measured for safety. Instead, traditional safety measurements were established such as lost time accidents and number of safety incidents. The only projected savings of time were in the physical security and personnel reliability areas. And these savings related mostly to administrative time.

The hours that are noted in Table 8 are the hours of effort for MRI for each three-month period (quarter). The hours relate to administrative hours, to include processing paperwork, making new forms and reporting to and receiving answers from the government. The baseline period ended in September 1996 and the trial period ended in December 1997. [Ref. 1]

Measurements other than labor effort were used to make certain there were no deleterious effects as the result of reinvention. Therefore, security incidents, permanent disqualifications, positive drug tests and theft attempts were added to assure the move to commercial standards did not affect the overall security posture at MRI.

Processes Measured	Baseline Measurements	Test Period Measurements	Benefit
Physical Security			
1. Intrusion Detection System Maintenance (Hours/Quarter)	17 Hours/Quarter	3 Hours/Quarter	14 Hours/Quarter
2. Entry Control (Hours/Quarter)	30 Hours/Quarter	3 Hours/Quarter	27 Hours/Quarter
3. Security Incidents (#)	0	0	No Change
Personnel Reliability Program (PRP)			
1. PRP Administration (Hours/Quarter)	68 Hours/Quarter	20 Hours/Quarter	48 Hours/Quarter
2. PRP Processing (Days)	270 Days	20 Days	250 Days
3. Permanent Disqualifications (#)	0	0	No Change
4. Positive Drug Tests (#)	0	0	No Change
5. Theft Attempts (#)	0	0	No Change
Safety			
1. Lost Time (Hours/Quarter)	0	0	No Change
2. Chemical Incidents (#)	1 (entire baseline)	0	1
3. Facility Damage ($)	0	0	No Change
4. Mission Downtime (Hours/Quarter)	0	0	No Change

Table 8. Summary of MRI's Benefits During Waiver Period.

The benefits summarized in Table 8 are used in Chapter IV to complete the cost-benefit analysis. Some of the benefits are qualitative in nature and are therefore not seen in the traditional sense as cost benefits. These qualitative benefits are also discussed in the analysis section of Chapter IV.

b. Responses of Benefit from MRI Employees

More benefits have accrued over time from the original inception of the Guidebook of Performance Standards. The following responses from employees at MRI are provided as a result of the questionnaire sent to them (Appendix A):

- The Guidebook is one reference and refers to standards and regulations business operations are familiar using; which reduces the learning curve. The safety plan (previously required) incorporated more than one Army regulation that business operations are not familiar with; which increases the learning curve.
- Placement of personnel into the Employee Reliability Program (ERP) is quicker – it took 6 months or longer to get a National Agency Check (NAC) back; now it takes a few days to a couple of weeks for a local records check.
- Significantly fewer close calls to make. Guidebook, though not totally answers questions, does lighten the load.
- Time to get staff in place for work has resulted in savings from a business sense. [Ref. 6]

The Guidebook provides MRI benefits that do not relate to specific cost measurements. A significant benefit is the "one stop shopping" attribute of the Guidebook, which is inferred from the first quotation above. The old Bailment Agreement included over 600 pages with references to at least six Army regulations. MRI had to have both the contractual language of the Bailment Agreement and all of the Army regulations. This preponderance of requirements was tedious. The new Bailment Agreement refers only to the Guidebook, which includes less than 70 pages total. MRI does not need any other Army regulation in order to manage its laboratories.

Another significant benefit to MRI (taken from the second quotation above) is the quicker process to put a chemist or technician to work with chemical agents. The Army regulation requires a National Agency Check (NAC) for all employees having access to chemical agents. The NAC (sometimes referred to as a clearance) is normally required for government and contractor employees who need access to classified material. However, chemical agents are not classified. The Army regulation also requires a government employee to be the contractor certifying official. That is, no one can work with chemical agents unless the government certifying official (normally the contracting officer's representative) checks all of the contractor employee's records and gives his or her approval. The Guidebook places the certifying official responsibility on the contractor laboratory manager. These improvements allow MRI to put a person to work on a government contract 250 days sooner than with the Army regulation.

Though benefits such as "one stop shopping" and putting people to work 250 days sooner are not included in the monetary benefits, they are significant benefits. These benefits are not included in the cost-benefit analysis in Chapter IV. However, these benefits save many hours in phone calls and conversations with government technical and contracting personnel. And these benefits allow for contract work to begin and finish sooner since MRI does not have to wait nearly eight months to add an additional chemist or technician to the chemical agent research contract effort.

4. Risks of Using the Guidebook of Performance Standards

Though there are significant benefits, both quantitative and qualitative, to using the Guidebook, there are also risks. These risks are presented from the perspective of both the MRI and the Department of the Army. Dr. James Spigarelli, Executive Vice President and Chief Operating Officer at MRI presents MRI's statements of risk. The Department of Army's risk are presented by representatives of both the US Army Nuclear and Chemical Activity (USANCA) and the US Army Office of the Deputy Chief of Staff for Operations (ODCSOPS).

a. MRI's Business Risk

The following business risks to MRI are comments from Dr. Spigarelli, the Chief Operating Officer (COO) at MRI. His concluding statement of benefits versus risks is included in this section, rather than in the benefits section, because it ties his ideas together.

- There is a risk in making it easier for others to enter the game after we have such high sunk costs in facilities and specialized knowledge in following the old rules that no longer apply.
- Whenever you move to a system which allows more judgement, there is a risk that if something goes wrong you, as the contractor will be blamed because it is easier for the government to do so.
- Any new system involves risk because of the potential for misinterpretation on both sides and not knowing how the new program will really be administered.
- There is a risk that the supporters of the new system will move on and the next regime will return to the old system or yet another one.

- I believe the benefits of the new system far outweigh the risks because it puts decision making at the appropriate level. It allows enough scientific freedom that enables you to keep better people in the system. It eliminates nonproductive overhead costs for both the contractor and the ultimate customer. Neither the contractor nor the customer fully recovers the added overhead costs. [Ref. 33]

Dr. Spigarelli's risk concerns are analyzed in Chapter IV.

b. Army Risks

This section delineates the Army's risks of replacing Army regulations with commercial performance standards. The statements of risk are taken from two memorandums from the Army's Office of the Deputy Chief of Staff for Operations (ODCSOPS) and a telephone conversation with a representative of the US Army Nuclear and Chemical Agency (USANCA) which is the regulatory proponent's technical expert. The proponent for both the chemical surety and chemical agent security regulations is the Army's ODCSOPS.

(1) Original rejection of the reinvention initiative. The first statement of risk is taken from the ODCSOPS response to the original request for waiver by CBDCOM (a major subordinate command to the Army Materiel Command) in February 1995.

- Nonconcur with Army Materiel Command (AMC) request to waive Army physical security requirements for chemical agents at Government and civilian contracted research, development, test and evaluation (RDTE) laboratories.

- AR 190-59, 27 Jun 94, Chemical Agent Security Program, prescribes policies, procedures and minimum standards for the physical security of . . . chemical agents as defined in AR 50-6, 1 Feb 95, Chemical Surety. It is Army policy that the lethal characteristics of chemical agents warrant extraordinary security measures to ensure they are properly safeguarded. Chemical agents are inherently dangerous, potentially lethal and possible targets for theft, sabotage or unauthorized use.

- Replacing Chapters 13 and 14, AR 190-59, with 21 Code of Federal Regulation (CFR) 1300 is inappropriate. The CFR is a regulation concerning medical controlled substances, administered by the Department of Justice Drug Enforcement Agency, which does not possess the expertise to oversee the Army Chemical Security Program. Additionally, 21 CFR 1300 generalizes physical security requirements and fails to provide detailed guidance needed for a comprehensive physical security program. [Ref. 34]

(2) Further Policy Guidance. In a more recent memorandum of nonconcurrence by the Army's ODCSOPS, the proponent provides more evidence of risk to the Army. These comments were sent to the newly established U.S. Soldier and Biological Chemical Command (was CBDCOM) on 12 January 1999. In the memorandum, ODCSOPS based their decision on:

- The continuing threat to chemical agents as identified by the Department of Defense/Department of the Army "Threat Statement for U.S. Government Nuclear/Chemical Weapons, Programs and Facilities".

- Recent world events like the World Trade Center and the Oklahoma City Bombings; reports from Army Depots of information gathering on security operations for transport of chemicals, arms and ammunitions; and the Japan subway incident lend credence to a threat to these lethal items. Intelligence gathering organizations have identified a terrorist organization that is attempting to obtain biological and chemical agents to inflict mass casualties on U.S. personnel.

- The waiver of personnel reliability policy to authorize contractor personnel to have access to chemical agents without undergoing the more stringent background check in the Army Personnel Reliability Program. The Employee Reliability Program being used for contractor personnel does not provide a complete check of an individuals background. [Ref. 35]

(3) Ongoing Risks. From conversations with the Army proponent's technical expert, the major risk to the Army from converting to commercial standards at chemical agent research laboratories is the perception that the Army has reduced its security posture at contractor laboratories. If an accident or incident occurs at a contractor laboratory, the Army will be under more scrutiny because of the changes. In fact, embarrassment is possibly the largest Army risk stemming from the reinvention efforts. [Ref. 36]

This risk of embarrassment is weighed against the fact that there has never been a theft attempt or break-in at the MRI chemical agent laboratories [Ref. 6]. In fact, there is no record of break-ins at any of the contractor laboratories since they began performing research with chemical agents in the early 1960s.

c. Summary of Risks

Table 9 provides a summary of the business risks to MRI and national security risks to the Army. These risks are analyzed in Chapter IV.

Business Risks to MRI in Converting to Commercial Performance Standards	National Security Risks to the Army in Converting to Commercial Performance Standards
It is easier for other commercial laboratories to get into the chemical agent research business.	The lethal characteristics of chemical agents warrant extraordinary security measures to ensure they are properly safeguarded.
If something goes wrong, the contractor will most likely be blamed.	Chemical agents are inherently dangerous, potentially lethal and possible targets for theft, sabotage or unauthorized use.
There is potential for misinterpretation by the contractor and Army.	Commercial standards generalize physical security requirements and fail to provide detailed guidance needed.
Do not know how the program will really be administered.	Recent world events like the World Trade Center, the Oklahoma City bombings and the Japan subway incident lend credence to chemical agent lethal threats.
The supporters of the new standards will move on and the next regime will return to the old standards or other new standards	Intelligence gathering organizations have identified a terrorist organization that is attempting to obtain biological and chemical agents.

Table 9. Summary of Risks to MRI and the Army.

5. Other Reinvention Initiatives

In order to discover if other agencies have performed similar cost, benefit and risk analyses, representatives of other government agencies were contacted. Representatives from reinvention offices within the Army, Navy, Air Force and Department of Energy were queried as to similar reinvention efforts with hazardous materials and as to cost analysis during conversion from military requirements to commercial performance standards.

Due to the extent of reinvention in the federal government, the surveys and interviews do not cover all government reinvention efforts or even all DOD reinvention efforts. Rather, the surveys and interviews are specific to the reinvention effort of the

Guidebook of Performance Standards for MRI and reinvention efforts relating to hazardous materials and contractors.

a. Army Efforts in Reinvention

The Army Reinvention Office and several subordinate command reinvention offices were contacted in order to gain their experiences with similar reinvention efforts. The interviews center on hazardous materials reinvention efforts and cost-benefit analyses of converting from military specifications to commercial performance standards. Table 10 summarizes the Department of Army agency contacts and their efforts.

The only Army reinvention effort related to both hazardous materials and contractors, according to the Army Reinvention Office, is the reinvention effort under study (converting from Army regulations pertaining to chemical agent research to the Guidebook of Performance Standards). The Army's Defense Standardization Program, managed out of Redstone, simply writes performance documents that include hazardous materials. It is up to the contractor to figure out how to manage to these functional requirements. No costs are measured at contractor facilities making these functional changes. [Ref. 39]

ARMY AGENCY	POINT OF CONTACT	SIMILAR EFFORTS
Dept of the Army	Diane Farhat, Army Reinvention Office [Ref. 37]	TRADOC – effort for HAZMAT training with CD versus instructor. TRADOC – effort to eliminate requirement for mandating additional Fire and Emergency Positions to staff HAZMAT and rescue vehicles. FORSCOM – effort to allow installations to use disposal agents other than DRMO on a routine basis. AMC – effort to authorize MACOMS to store hazardous materials in Underground Storage Tanks (USD).
Dept of the Army – Army Research Laboratory (ARL)	Dr. Ed Brown, ARL Reinvention Office [Ref. 38]	Effort for ARL to develop and use their own tailored hazardous materials tracking system that meets all regulatory reporting requirements.
Dept of the Army – Redstone Arsenal	Bill Smith, Defense Standardization Program [Ref. 39] Ron Hagler, Environmental Technology Team Post Office [Ref.40]	Convert detail specifications into performance documents. Have not measured conversion costs. Have never required a contractor to follow an Army Regulation.
Dept of the Army – Intelligence Security Command	Robyn Walick, INSCOM Reinvention Office [Ref. 41]	Some internal efforts relating to protection of information. No work with contractors or hazardous materials.

Table 10. Similar Army Reinvention Efforts.

There are extensive ongoing efforts, at Redstone, in relation to military specifications and hazardous materials. These efforts are expended at government expense. Though they do not directly relate to the reinvention effort of this research, the

efforts are very important to the private sector. These efforts, by the Environmental Technology Team, are summarized as follows:

- During the past year, my team has expended about two man-years on reviewing and documenting hazardous materials in about 1300 milspecs, commercial specs and missile interim specs. I need to point out that this effort ONLY documents the materials, not revise the document. There has been some development of tailoring language for contracts performed where we could find an alternative material, but mostly it simply identifies the material. These documents range from a few pages to several hundred pages.

- My team has also performed reviews and revisions on about 400 maintenance documents. Some of these revisions have been major. During the past year, we have spent about three man-years in the identification of offending materials in these documents and about 11 man-years in the revision of the documents to remove the offending materials. This last effort includes coordination of the recommended replacements through a complex approval process. This part of the work we do is very labor intensive. There is an effort underway to significantly alter our business process and to automate this process as much as possible.

- To date, we have not identified direct cost savings but rather tried to identify cost avoidances. Since we are pursuing pollution prevention here, we are attempting to forestall the expenditure of costs for liabilities and risks traditionally taken and to reduce those risks early. Direct linkage to savings in current operations have not been identified nor, I suspect, realized yet. I believe these things will be occurring in the coming years. [Ref. 40]

The efforts at Redstone are crucial to the future of the Army; however, the results of these efforts will simply be given to outside contractors for their implementation. Though Redstone has experienced costs for these efforts, they are not looking to balance these outlays with cost benefits. They are more concerned with the reduction of risks and

potential litigation costs. These Redstone comments are the only comments that remotely relate to the reinvention effort under study.

b. Other Government Agency Efforts in Reinvention

Table 11 summarizes other agency reinvention efforts reported. It is interesting to note that few agency points of contact mention any contractor efforts relating to reinvention. The Department of Energy has done some work with construction contractors, but has not performed any cost, benefit or risk analyses related to these efforts [Ref. 43].

AGENCY	POINT OF CONTACT	SIMILAR EFFORTS
Department of Energy	Robert Stewart, Hanford Research Labs [Ref. 42]	No cost/benefit/risk comparisons. Suggested Steve Sandlin and Dr. Amoret Bunn.
Department of Energy	Steve Handlin, Bechtel Hanford, Inc. [Ref. 43]	Has attempted reinvention efforts – but to no avail. Many efforts relate to RCRA and CERCLA that require strict adherence to EPA and State EPA rules and regulations.
Department of Energy	Dr. Amoret Bunn, Battelle, Pacific Northwest National Lab (PNNL) [Ref. 44]	Referred to Battelle's effort with Edgewood relating to chemical agent reinvention – which is the reinvention effort under study.
Department of the Navy	Fred Riedl, Naval Surface Warfare Center, Dahlgren Division, Systems Research and Technology Department [Ref. 45]	Efforts with commercial standards for fiber optics. Have had to defer to commercial standards instead of military specifications in order to buy material. No cost/benefit analyses performed.
Department of the Air Force	Charlie DiPietro, Air Force Reinvention Office [Ref. 46]	The Air Force does not require cost-benefit analyses to be performed for reinvention efforts.

Table 11. Similar Reinvention Efforts by Other Agencies.

The Naval Surface Warfare Center, Dahlgren Division, has worked with contractors furnishing fiber optic components. Their efforts have been in persuading contractors to add military unique requirements to commercial standards for fiber optics that already exist. They have had some success in selling the idea of robustness to contractors; however, their buying power is limited in relation to the commercial sector. [Ref. 45]

There has been extensive work at the Air Force relating to single process initiatives (SPI). The Air Force Single Process Initiative (SPI) Guide defines the process as follows:

> SPI is an acquisition reform initiative designed to reduce costs associated with doing business with the Government. It is a streamlined approach to change to performance based contracting and allow industry to use best practices and commercial processes, specifications, and standards. SPI allows block contract changes to implement common processes and replace or eliminate military standards and specifications and business requirements when they don't add value. SPI also allows contractors to reduce costs by adopting new acquisition reform initiatives on existing contracts. It gives contractors the ability to move to the most efficient business and manufacturing processes for their individual facilities and the products they produce. [Ref. 47]

Single Process Initiatives are used primarily with large government contractors who have many different contracts with different agencies. It allows the contractor to use one set of rules instead of many. SPI takes into account that the contractor is already following certain government-approved practices (such as ISO 9000). It does not take into account converting from one set of practices to another – which is the effort under study. It also does not apply to legal or regulatory guidance. [Ref. 47]

D. COMPARATIVE PROCESS ANALYSIS

It is beyond the scope of this research to duplicate all of the Army regulations pertaining to chemical agent safety, security and personnel reliability. Even the Guidebook of Performance Standards is nearly 70 pages long. The comparison of Army regulation processes to commercial performance standard processes are therefore limited to a couple of examples. These examples include two requirements from Army regulations and their counterparts in the Guidebook of Performance Standards.

In order to better compare the two processes – the Army regulations and the Guidebook – sections of each have been reproduced in appendices B through E. The list of appendices are provided below:

- Appendix B – Army's disqualification requirements for the personnel reliability program (PRP). These requirements pertain to all government and contractor employees.
- Appendix C – The Guidebook's disqualification requirements for the employee reliability program (ERP). These requirements pertain only to contractor employees working in contractor laboratories or government laboratories.
- Appendix D – Army's vulnerability assessment requirements for all government and contractor facilities – to include chemical weapon storage sites and laboratories storing small quantities of chemical agents.
- Appendix E – The Guidebook's vulnerability assessment requirements for contractor owned, contractor operated laboratories only.

The appendices include only small segments of each process. The requirements for the standard Army process of managing laboratories create contract language of more than 600 pages. The requirements for the Guidebook process of managing laboratories total nearly 70 pages. Review of the appendices provides a clear comparison of the two management processes.

E. SUMMARY

This chapter describes three main areas of research. First, the costs, benefits and risks of converting from Army regulations to commercial performance standards were presented. Then commercial performance standards that have the best fit to the current Army regulations for chemical agent research were presented. Finally, reinvention efforts by other government agencies, pertaining to hazardous materials and cost, benefit and risk analysis were presented.

Now that the data have been presented, an analysis of these data is needed. The next chapter provides a thorough analysis of the costs, benefits and risks of converting from Army regulations to commercial performance standards. This analysis answers the primary research question, what are the costs, benefits and risks of performing chemical agent research at contractor laboratories when U.S. Army detail specifications are substituted with consensus performance standards.

IV. COST, BENEFIT AND RISK ANALYSIS

In this chapter, costs and benefits are determined related to the transition from Army regulations to commercial performance standards. A cost-benefit analysis is performed, followed by an analysis of risks.

A. COST-BENEFIT ANALYSIS

1. Assumptions

The costs to MRI to write the plans and procedures (and train to these new plans and procedures) are found in Section C of Chapter III. These costs are applied to the period of transition, which is August through November 1996. Benefits do not begin to accrue until late November 1996. This transition period spans two fiscal years. For the purpose of this cost-benefit analysis, half of the costs to transition are calculated using FY96 direct labor rates (August and September) and half of the costs to transition are calculated using FY97 direct labor rates (October and November). Benefits from the transition are calculated using FY97 through FY99 direct labor rates since the payback is less than three years.

The costs to MRI to transition from Army regulations to commercial performance standards (as found in Tables 6 and 7 of Chapter III) are:

- Direct Labor Costs - $10,552 (Rounded)
- Opportunity Costs - $12,429 (Rounded)

Benefits to MRI, accrued as a result of transitioning to commercial performance standards, are also found in Table 8 of Chapter III. These benefits are summarized and annualized in Table 12. The first three benefits result in increased operational efficiency at MRI. As such, these are actually benefits to the government. The last benefit (PRP Processing) results in increased effectiveness for MRI in how it serves its chemical agent customers. PRP Processing is a benefit to MRI.

Processes Measured	Quarterly Benefit	Annual Benefit
Physical Security Intrusion Detection System (IDS) Maintenance (Hours/Quarter)	14 Hours/Quarter	56 Hours/Year
Entry Control (Hours/Quarter)	27 Hours/Quarter	108 Hours/Year
Personnel Reliability Program (PRP) PRP Administration (Hours/Quarter)	48 Hours/Quarter	192 Hours/Year
PRP Processing (Days)	250 Days	8 Work-months/Person 1176 Hours/Year/Person

Table 12. Summary of Benefits.

In order to calculate projected monetary benefits, the processes which create benefits are matched with the labor categories necessary to accomplish them. Intrusion detection maintenance is performed by technical personnel. Laboratory entry control is performed by professional chemists (scientists). Personnel reliability program administration is performed by administrative (clerical) personnel. Individuals required to gain access into the PRP are chemists (scientists).

Using the hourly rates from Table 2 of Chapter III, annual benefits can be calculated for each process measurement in Table 12. Annual benefits begin to accrue in FY97. Benefits are measured for three fiscal years in order to evaluate the payback period. These annual direct labor benefits are summarized in Table 13.

Process Measured	Labor Category	FY97	FY98	FY99
IDS Maintenance	Technician	$823	$781	$820
Entry Control	Scientist	$2454	$2683	$2762
PRP Administration	Clerical	$2356	$2611	$2120
PRP Processing Days	Scientist	$26,719 per Scientist	$29,212 per Scientist	$30,070 per Scientist

Table 13. Summary of Annual Direct Labor Benefits.

Escalation rates for each fiscal year were taken from the Cost Analysis Branch of the Army's Edgewood Chemical and Biological Center, Edgewood, Maryland. These escalation rates are found in Table 2 in Chapter III. Conversions from Army labor categories to MRI labor categories are found in Table 4 of Chapter III. [Ref. 30]

MRI's costs to transition from Army regulations to commercial performance standards include opportunity costs of overhead, general and administrative (G&A) expense and profit. Benefits also include overhead, G&A expense and profit. For example, if MRI can place a scientist on the job eight months sooner using the Guidebook of Performance Standards, then MRI can accrue overhead, G&A expense and profit for that entire eight-month period for that scientist. Table 14 summarizes the overhead, G&A expense and profit for each benefit. The explanations for overhead, G&A expense and profit are found in Table 3 of Chapter III.

Process Measured	Labor Category	FY97 O/H, G&A & Profit	FY98 O/H, G&A & Profit	FY99 O/H, G&A & Profit
IDS Maintenance	Technician	$970	$920	$966
Entry Control	Scientist	$2,891	$3,161	$3,254
PRP Administration	Clerical	$2,775	$3,075	$2,497
PRP Processing Days	Scientist	$58,189 per Scientist	$63,619 per Scientist	$65,488 per Scientist

Table 14. Summary of Annual Overhead, G&A and Profit Benefits.

According to MRI, there were eight scientist added to their personnel reliability program since the inception of the Guidebook of Performance Standards. These eight scientists were added over a three year period from FY97 to FY99. Two scientists were added in FY97 and three scientists were added in each of FY98 and FY99. Under the Army regulations, these scientists could not be placed to work on contracts requiring access to chemical agents until 270 days after security clearances were initiated. Under the Guidebook of Perfromance Standards, these same scientists can be placed to work 20 days after local records checks are initiated. This time savings allows scientists to be charged to government contracts and accrue overhead, G&A expense and profit for MRI 250 days (approximately eight-months) sooner with the Guidebook. [Ref. 48]

An important assumption to make for the cost-benefit analysis concerns the discount rate. MRI is a not-for-profit research institute. As such, discount rates for new projects are not viewed in the same context as for-profit industries. In response to the question of what MRI uses as a discount rate for new projects, Dr. Spigarelli, Chief Operating Officer of MRI, responded by stating:

> We probably never think in those terms on a project basis. For something as cost intensive as chemical agent research, we think more broadly. If we can make any profit at all on the individual projects in this area, it is worth doing. Over time and in a broader context, we look for 8 – 15%. We would not have remained in the chemical agent business at all over these years if the chemical business didn't serve as an effective loss leader for related intel (intelligence), environmental and industrial business. Our volume was not sufficient to justify it. But its impact on the broader business base made it worthwhile. Many of the related business areas required minimum proposal preparation costs so the chemical agent related costs were a tradeoff. [Ref. 33]

Using Dr. Spigarelli's comments, two discount rates (eight and fifteen percent) are used for the cost-benefit analysis. The rates of eight and fifteen percent are used to determine if the net present value of the benefits received from the transition to commercial performance standards is more or less than the initial transition investment based on Dr. Spigarelli's discount criteria.

The only remaining assumption for the cost-benefit analysis is to determine which benefits match which costs. The ability to place a scientist to work on a government contract eight months sooner with the Guidebook of Performance Standards is clearly a benefit to MRI. With the Guidebook, MRI utilizes its employees more effectively with customer orders. Charging a scientist to a government contract eight months sooner allows MRI to gain direct labor costs, overhead, G&A expense and profit for the scientist's efforts. This also aids MRI because it does not have to request contract extensions or subcontract research hours due to inadequate scientist resources. Therefore, MRI's costs to transition to commercial performance standards are associated with the benefits accrued from placing scientists to work eight months sooner.

The annual direct labor benefits summarized in Table 13 and the annual overhead, G&A expense and profit benefits summarized in Table 14 are benefits to the government. These benefits relate to efficiencies created by the transition to commercial performance standards. On any given chemical agent contract, MRI's direct labor, overhead, G&A expense and profit are decreased with the application of commercial performance standards. These contract costs were charged to the government when MRI operated under Army regulations. For the purposes of the cost-benefit analysis, these benefits are associated with the government's contract costs to write the Guidebook of Performance Standards. The government's contract with the Chemical and Biological Defense Information Analysis Center (CBIAC) cost the Government $115,450 [Ref 21 and Ref 23]. The contract with CBIAC is discussed in Chapter II.

The government's contract costs of $115,450 are divided by the six contractor laboratories that perform chemical agent research using the Guidebook of Performance Standards. Each contractor benefits to the same degree while using the Guidebook of Performance Standards [Ref. 1]. Therefore, MRI's portion of the government's contract costs are $19,242 ($115,450 divided by six).

2. Cash Flow Analysis

a. Definition of Cost-Benefit Analysis

In *Cost Accounting – Creating Value for Management, Fifth Edition,* Maher defines cost-benefit analysis as follows:

> The process of comparing benefits (often measured in savings or increased profits) with costs associated with a proposed change within an organization. [Ref. 49]

b. Cost-Benefit Analysis using Net Present Value

Using Maher's procedures for cash flow analysis, the net present values to convert from Army regulations to commercial performance standards are calculated. Net present values are calculated for discount rates of eight and fifteen percent. Table 15 summarizes the cash flow for MRI and includes assumptions previously stated in this chapter. Table 16 summarizes the cash flow for the government.

The net present value of transitioning from Army regulations to commercial performance standards is the sum of the present values calculated for each fiscal year for MRI and the government. For MRI, the net present value represents the value of the conversion project in FY96 and FY97. For the government, the net present value represents the value of the contract effort with the CBIAC in FY96. [Ref. 49]

For MRI, the present values represent the future cash flows (FY97 – FY99) generated from using scientists on chemical agent research projects 250 days early, which are discounted to their equivalent values in FY96. For the government, the present values represent direct labor, overhead, G&A expense and profits not paid to MRI due to efficiency improvements, which are discounted to their equivalent values in FY96. Information found in Tables 15 and 16 are taken from Tables 6, 13 and 14. [Ref. 49]

Investment Flow	FY96	FY97	FY98	FY99
Direct Labor Costs	($5,278)	($5,274)		
Opportunity Costs	($6,217)	($6,212)		
Operating Flows				
Putting Scientists to Work 250 days sooner as a result of PRP Processing Time		2 Scientists $53,438	3 Scientists $87,636	3 Scientists $90,210
Overhead, G&A & Profit accrued as a result of PRP Processing Time		$62,940	$103,221	$106,254
Total Cash Flow	($11,495)	$104,892	$190,857	$196,464
Net Present Value Factor				
8%	-	0.926	0.857	0.794
15%	-	0.87	0.756	0.658
Present Values				
8%	($11,495)	$97,130	$163,564	$155,992
15%	($11,495)	$91,256	$144,288	$129,273
Net Present Value of Transition				
8%	$405,191			
15%	$353,322			

Table 15. MRI Transition Cash Flows.

The net present value for MRI's transition efforts is positve for both discount rates of eight and fifteen percent. According to the cash flow analysis, the benefits to MRI from transitioning to commercial performance standards far exceed the costs. Even at a discount rate of fifteen percent, Dr. Spigarelli meets his goal.

MRI's FY96 and FY97 investment of $22,981 was paid in full in FY97. Future savings will be approximately $27,000 each time it is necessary to place a new scientist into the chemical agent laboratories as a result of new chemical agent research. In

addition to the cost benefits exceeding the initial transition investment at MRI, MRI becomes more flexible in moving their scientists to any laboratory where they are needed.

Investment Flow	**FY96**	**FY97**	**FY98**	**FY99**
Guidebook Conract Costs	($19,242)			
Operating Flows				
Direct Labor Savings to the Government				
IDS Maintenance		$823	$781	$820
Entry Control		$2,454	$2,683	$2,762
PRP Administration		$2,356	$2,611	$2,120
Overhead, G&A & Profit Savings to the Government (as applied to direct labor)		$6,636	$7,156	$6,717
Total Cash Flow	($19,242)	$12,269	$13,231	$12,418
Net Present Value Factor				
8%	-	0.926	0.857	0.794
15%	-	0.87	0.756	0.658
Present Values				
8%	($19,242)	$11,361	$11,338	$9,860
15%	($19,242)	$10,674	$10,003	$8,171
Net Present Value of Transition				
8%	$13,317			
15%	$9,606			

Table 16. Government Transition Cash Flows.

The net present value for the government's contract efforts is positive for both discount rates of eight and fifteen percents. According to the cash flow analysis, the benefits to the government from the CBIAC contract effort to write the Guidebook far exceeds the costs of the contract. There was no initial requirement for the government to attain benefits exceeding costs. The Guidebook effort was initiated to allow the

contractor laboratories more flexibility. However, the government also benefits from the use of commercial performance standards due to lower contractor laboratory costs.

3. Other Benefits

As discussed in Chapter III, there are benefits to MRI that do not associate directly with cost benefits. The ability to use one seventy-page document for all of the requirements needed to operate a chemical agent research laboratory, instead of 600 pages of contractual language and at least six Army regulations, is a benefit. This "one-stop-shopping" reduces wasted time which MRI employees spend in the research of requirements.

In addition to these more obvious benefits, Dr. Spigarelli adds that the Guidebook of Performance Standards allows enough scientific freedom to enable MRI to keep better people in the system [Ref. 33]. Together, these benefits make a strong quality-of-the-workplace case for the transition from Army regulations to commercial performance standards. The use of the Guidebook is easier to understand and interpret, and allows more scientific freedom.

B. RISK ANALYSIS

Although the benefits from using performance standards exceed the costs to transition to performance standards, there are risks inherent in the move to commercial standards.

1. Business Risks to MRI

According to Dr. Spigarelli, the business risks to MRI associated with the transition to commercial performance standards are as follows:

- There is a risk in making it easier for others to enter the game after we have such high sunk costs in facilities and specialized knowledge in following the old rules that no longer apply.
- Whenever you move to a system which allows more judgement, there is a risk that if something goes wrong, you, as the contractor will be blamed because it is easier for the government to do so.
- Any new system involves risk because of the potential for misinterpretation on both sides and not knowing how the new program will really be administered.
- There is a risk that the supporters of the new system will move on and the next regime will return to the old system or yet another one. [Ref. 33]

Dr. Spigarelli's risk concerns are valid business concerns. His first concern of using performance standards to make it easier for other laboratories to get into the chemical agent research business has been expressed by other commercial laboratory managers. MRI and other institute laboratories have spent a great deal of time and effort preparing for and training to Army regulatory requirements which no longer apply. MRI has also spent time and money preparing for elaborate entry control procedures and intrusion detection inspection procedures which are no longer valid. With the Guidebook of Performance Standards, these requirements can be met using less expensive processes. Laboratories, that now wish to get into the chemical agent research business, will require less training and preparation than MRI.

Performance standards also place higher risks on MRI. Under the Army regulations, if something goes wrong, MRI can state it is following the Army guidance. Although there may be an investigation, as long as rules are followed, MRI shares less of the responsibility. However, under performance standards, MRI can be criticized for their interpretation of the standard. With materials as sensitive as chemical agents, mistakes create a finger pointing mentality. MRI can be judged at fault, which, to MRI, is perceived to be an advantage to the Army.

Finally, Dr. Spigarelli's comment "that the supporters of the new system will move on" is valid for this reinvention effort [Ref. 33]. If fact, most of the proponents of this reinvention effort to replace Army requirements with commercial performance specifications have either retired or transferred. Both the Commanding General of SBCCOM and the Technical Director of ECBC have retired. These two individuals were strong supporters of change. Their replacements are much more conservative. The Surety Manager at ECBC has taken another position within the Department of the Army. The thrusts of his efforts have stopped. His emphasis on continuous improvement of the Guidebook of Performance Standards is currently discontinued.

2. National Security Risks to the Army

According to the Army's physical security proponent, the national security risks of converting to commercial performance standards are summarized as follows:

- AR 190-59, 27 Jun 94, Chemical Agent Security Program, prescribes policies, procedures and minimum standards for the physical security of . . . chemical agents as defined in AR 50-6, 1 Feb 95, Chemical Surety. It is Army policy that the lethal characteristics of chemical agents warrant extraordinary security measures to ensure they are properly safeguarded. Chemical agents are inherently dangerous, potentially lethal and possible targets for theft, sabotage or unauthorized use. [Ref.34]

- Replacing Chapters 13 and 14, AR 190-59, with 21 Code of Federal Regulation (CFR) 1300 is inappropriate. The CFR is a regulation concerning medical controlled substances, administered by the Department of Justice Drug Enforcement Agency, which does not possess the expertise to oversee the Army Chemical Security Program. Additionally, 21 CFR 1300 generalizes physical security requirements and fails to provide detailed guidance needed for a comprehensive physical security program. [Ref. 34]

- Recent world events like the World Trade Center and the Oklahoma City Bombings; reports from Army Depots of information gathering on security operations for transport of chemicals, arms and ammunitions; and the Japan subway incident lend credence to a threat to these lethal items. Intelligence gathering organizations have identified a terrorist organization that is attempting to obtain biological and chemical agents to inflict mass casualties on U.S. personnel. [Ref. 35]

- The waiver of personnel reliability policy to authorize contractor personnel to have access to chemical agents without undergoing the more stringent background check in the Army Personnel Reliability Program. The Employee Reliability Program being used for contractor personnel does not provide a complete check of an individuals background. [Ref. 35]

a. Extraordinary Security Measures

The Army's proponent for physical security first states that "it is Army policy that the lethal characteristics of chemical agent warrant extraordinary measures to ensure they are properly safeguarded" and "Chemical agents are . . . possible targets for theft sabotage, or unauthorized use" [Ref. 34]. The Guidebook of Performance Standards

does not alleviate any of the physical security measures of the Army Regulation 190-59. It specifies the same double locks, intrusion detection systems, vaults and barriers that are required in the Army requirements. The main difference between the Army regulations and the Guidebook is that the Guidebook specifies the extraordinary physical security measures in four pages versus nearly 20 pages of regulatory contract language. [Ref. 26 and Ref. 56]

One example of the difference in language between the Army regulation and the Guidebook can be found in Appendices D and E. These appendices delineate the language concerning vulnerability assessments in the Army regulations (Appendix D) and the Guidebook of Performance Standards (Appendix E). Another example of differences in language between the Army regulation and the Guidebook relates to security force response time. In Section 14-10, the Army Regulation AR190-59 states:

> The response time for security forces or local police shall not exceed 15 minutes from the time of an intrusion alarm or report of a security incident. [Ref. 56]

The Guidebook of Performance Standards specifies the same requirement in the following manner:

> This security force must respond within a period of time commensurate with the delaying mechanisms up to the secure storage container. [Ref. 26]

There is a significant difference between the language of the Army regulation and the Guidebook. The Army delineates a specified 15 minute response time. In some cases, 15

minutes is too late to respond to an alarm at a chemical agent laboratory. The Guidebook's performance language dilineates that the security force must arrive before an intruder can access the chemical agent secure container. This means that from the time an alarm is activated until the time an intruder can access chemical agent, the security force must arrive. In some commercial laboratories, it takes less than 15 minutes to blow the doors entering laboratories and cut locks to storage areas. To fulfill the Guidebook's requirement, MRI must demonstrate that the Kansas City Police Department consistently responds to an alarm in less time than a knowledgeable intruder can access their chemical agent storage container. The time required to access is business sensitive, but it is less than 15 minutes. [Ref. 26]

The security response requirement of the Guidebook of Performance Standards is more stringent than the security response requirement of the Army regulation. There are other cases where the Guidebook provides more stringent language, even though the language is performance based rather than detail based. The 15 minute response time provided by the Army regulation does not provide "extraordinary security measures to ensure (chemical agents) are safeguarded," but the Guidebook does [Ref. 34].

b. Generalizing Physical Security Requirements

The Army's proponent for physical security argues that the controlled substances performance standards, specified in 21 CFR 1300, are inappropriate because they generalize physical security requirements and fail to provide detailed guidance. This is the purpose of performance standards – they should not provide detailed guidance. In

the example of response time given above, the Guidebbok does not tell MRI how many minutes to plan for as a response time. A 15 minute response time is fairly simple to meet. The Guidebook specifies that MRI must design barriers sufficient to keep intruders away from their chemical agent storage until the Kansas City Police arrives at MRI. The guidance is generalized, but it puts the onus on MRI to prove that the Kansas City Police Department can arrive at MRI before an intruder can gain access to chemical agents stored in their laboratories. The performance requirement of the Guidebook requires MRI to add as many physical barriers as are necessary to detain an intruder until the Kansas City Police Department arrives. The framework of 21 CFR 1300, as discussed in Chapter II, allows for many theft related physical security performance requirements. [Ref. 31]

c. Terrorist Bombings

The Army's proponent for physical security states that the World Trade Center and Oklahoma City bombings and the Japan subway incident "lend credence to a threat of these lethal items" [Ref. 35]. Other than the Japan subway incident, there has been no use of chemical or biological agents in previous terrorist bombings. And the Japan subway bombing was caused by a group that made its own chemical agent. All of these bombings used products that were purchased and made into high explosives or chemical agent.

A search on the worldwide web discovers a good deal of information about chemical agents, to include the molecular formulas and Chemical Abstract Service registry numbers (used to order chemicals). There is a great deal of information on the worldwide

web in regard to Sarin (chemical agent GB), which was used by the Japanese terrorist group for the Japan subway incident in March 1995. Websites, and the references attached to them, give sufficient information for a knowledgeable chemist to experiment with and eventually produce the chemical agent GB. [Ref. 50]

d. Insufficient Information on Personnel

The Army's proponent for physical security states that the Guidebook does not require a complete check of an individuals background [Ref. 35]. This comment relates to the use of local criminal records checks versus National Agengy Checks (NACs). The Army's proponent states that only a NAC can provide the criminal information necessary to decide whether an indidual can be granted access to chemical agents. This reasoning is based on the fact that a NAC uncovers federal crimes that a local criminal records check may not.

During Contractor/Government Working Group Meetings, it was argued by the Army's Chemical and Biological Command Intelligence personnel that local criminal records checks uncover local criminal activity that is not available to National Agency Checks. It was also argued that unlike military personnel who often relocate from one military installation to another during the course of their careers, regional institute laboratory personnel remain local. This is true at MRI where all of the laboratory personnel who have access to chemical agent are lifelong residents of the immediate Kansas City area (within a 50 mile radius) [Ref. 6].

It is not within the sope of this research to uncover the differences between National Agency Checks and local criminal records checks. It is recommended, in Chapter V, that this research be performed as an additional research effort.

3. Methods of Risk Analysis

In the National Aeronautical and Space Administration (NASA) Risk Assessment Overview for its Earth Observing System Core System (ECS), the risk assessment methodology begins as follows:

- A risk assessment is the determination of risk exposure. The determination of risk exposure may be established through quantitative or qualitative evaluation of risks using detailed analyses or by general assessment. Usually, rather than trying to precisely measure risks, security efforts are better served by generally assessing risks and taking actions to manage them.
- Risk assessment should be a structured process, based on established principles, by which one can determine risk exposure and how to manage it. The precise approach, tools or level of detail, however, will most likely vary with each assessment because of differing configurations or circumstances.
- The following steps reflect the ECS risk assessment methodology.
    - Identify resource vulnerabilities and associated potential threats
    - Weigh the degree of risk that each threat represents, if it realized, against the potential harm to or loss of assets
    - Establish the relative value or worth of the assets
    - Establish an acceptable level of risk
    - Select and implement appropriate protective measures to minimize potential harm or loss [Ref. 50]

Using NASA's risk assessment methodology, analyses of vulnerabilty, degree of risk, worth of chemical agent access, acceptable level of risk and appropriate measures to minimize risks are performed in the following sections.

a. Assessment of Vulnerability at MRI

The vulnerability assessment at MRI is a document that assesses the vulnerabilty of MRI's chemical agent laboratories to sabotage, terrorism or other unauthorized penetration or access. The vulnerability assessment was written at MRI with the following intelligence gathering organizations assisting:

- Kansas City Police Department
- Federal Bureau of Investigation (FBI - Kansas City Office)
- Fort Leavenworth Military Intelligence
- Bureau of Alcohol, Tobacco and Firearms (ATF)
- Department of Defense Security Services
- Missouri State Highway Patrol [Ref. 52]

The MRI vulnerability assessment is reviewed and updated annually by MRI and, as determined by Dr. Swann, MRI's Security Manager, includes those intelligence gathering organizations mentioned above. The FBI, Missouri State Highway Patrol or Military Intelligence at Fort Leavenworth notifies Dr. Swann if there is a change in the threat in the Kansas City area.

Marion Wright, MRI's security specialist, meets with the Kansas City Police Department and the Bush Creek Partner Security Board monthly. The Bush Creek Partner Security Board is a security group representing approximately 20 businesses in the vicinity of MRI's Kansas City laboratories. [Ref. 52]

MRI has immediate access to changes in the threat in the Kansas City area. If there is any change to the threat to chemical agents in the Kansas City area, MRI is notified through FBI, military intelligence and state and local police networks. If the threat to chemical agent increases, MRI can increase its security posture by adding contract security forces or additional physical barriers. [Ref. 52]

b. Degree of Risk Versus Potential Harm

In order to predict the degree of risk, it is necessary to look at the history of risk exposure at MRI for chemical agents. MRI began working with chemical agents in April 1963 [Ref. 6]. Between April 1963 and May 1999, MRI has performed research with chemical agent for approximately 36 years. In that 36 years, MRI has never experienced a theft or theft attempt, sabotage or unauthorized use [Ref. 6]. This compares to the Army's stated risk that chemical agents are "possible targets for theft, sabotage or unauthorized use" [Ref. 34]. Although chemical agents are possible targets for theft, sabotage or unauthorized use, there are no records at the Edgewood Chemical and Biological Center that cite an instance of theft, sabotage or unauthorized use at any contractor facility since the inception of contractor research with chemical agents in 1960 [Ref. 53].

It is not possible to state that there is no risk of theft, sabotage or unauthorized use of chemical agents simply because no instance has occurred in the 39-year history of chemical agent research at contractor laboratories. However, it appears that there is no

increased risk when Army regulations are replaced with commercial performance standards, which is the scope of this research.

As previously stated in Chapter II, contractor laboratories did not come under Army regulations until the 1986 version of Army regulation AR50-6. Prior to 1986, contractor chemical agent research was managed by each DOD Service. After July 1996, contractor chemical research was governed by the requirements of the Guidebook of Performance Standards. Therefore, there is about a ten-year period of time that contractor laboratories performed chemical agent research under Army requirements. This compares to about 29 years that contractor laboratories performed chemical agent research under an assortment of DOD Service guidance.

Since there are no records of theft, sabotage or unauthorized use of chemical agents during the 39-year history of contractor research with chemical agents, there appears to be no difference as to which guidance is used. This does not conclude there is no risk. The conclusion is only that the contractor laboratory research community has managed the degree of risk regardless of which DOD Service provided the chemical agent guidance.

The potential harm of a theft attempt, sabotage or unauthorized use of chemical agent at MRI is serious. The consequences of a theft attempt, whether by a terrorist or an insider at MRI will have harmful repercussions to MRI, the Army and the contractor laboratory community as a whole. These repercussions include shutting the contractor laboratory operations down, thorough investigations by Congress, DOD and the press and even more stringent regulations for performing research in chemical agent laboratories.

c. Relative Worth of Chemical Agent

The Army states that the World Trade Center and Oklahoma City bombings and the Japan subway incident add credence to the threat of theft of lethal chemical agents. The Army also states that intelligence gathering organizations have identified a terrorist organization that is attempting to obtain biological and chemical agents. Therefore, there is some worth to chemical agents in regard to their use for terrorism. [Ref. 35]

d. Acceptable Level of Risk

NASA's Risk Asseement Overview states that "security efforts are better served by generally assessing risks and taking actions to manage them" [Ref 50]. Therefore, it is essential to manage risks. The Army does not provide a risk assessment process for the physical security of chemical agents. However, the Army Safety Office does provide a process for determining and managing risks for chemical agent operations.

Risks (whether security for NASA or safety for the Army) are assessed using both the severity (potential harm) and probability of their occurrence (degree of risk). In order to better picture how risks are assessed, the next two sections provide an example of the risk assessment processes used for determining safety risks when handling chemical agents. The processes lead to a decision by management to either accept or reject the risks. Setting the proper level of management approval is essential in performing operations with lethal materials, such as chemical agents.

The hazard severity and frequency categories used at the Edgewood Chemical and Biological Center for safety risk assessments are provided in Figures 1 and 2. These categories are used to place the level of responsibility for decisions at the Center in regard to hazardous operations. The process of using hazard severity and frequency ratings and the subsequent decision authority is approved by the Department of the Army Safety Office. [Ref. 54]

Since there is no Army physical security risk assessment process for chemical agents, for the purpose of this research the safety risk assessment process for chemical agent operations is used. Using the Army's Safety Office hazard severity and frequency categories delineated in Figures 1 and 2 and the degree of risk versus potential harm from an attempt of theft of chemical agents, the risk of a theft attempt is established.

Catastrophic	**I**	**Fatalities or serious injuries, loss of the facility, environmental release**
Critical	**II**	**Single fatality or serious injury, major facility damage, agent release within the facility**
Moderate	**III**	**Minor injury, minor equipment damage, agent release within engineering controls**
Negligible	**IV**	**No injuries, no equipment damage, no agent release**

Figure 1. Hazard Severity Categories – After Ref. [54].

Using Figure 1, the harm (consequence) of a chemical agent theft attempt is determined to be either critical or catastrophic. The severity is critical if the harm (consequence) is a single fatality, serious injury or agent release within the facility. This

would be the most likely scenario since chemical agents at MRI are stored in small glass vials. A vial containing five to ten milliliters of chemical agent is more likely to injure or kill the person carrying it.

The catastrophic category (of Figure 1) is the harm (consequence) of failure stated by the Army's physical security proponent [Ref. 34]. The Army's position is supported by the fact the MRI's laboratories would most likely be shut down in the event of a theft of chemical agent. The press may create enough pressure on the Kansas City community to force MRI out of the chemical agent business entirely. At best, MRI's laboratories would be shut down until a thorough investigation is completed. At worse, there would be multiple fatalities and all of the commercial laboratories would be shut down. This would place the consequence of failure as catastrophic.

Frequent	**A**	**Occurs often in facility or equipment service life**
Likely	**B**	**Occurs several times in facility or equipment service life**
Occasional	**C**	**Occurs infrequently/sporadically or some time in facility or equipment service life**
Seldom	**D**	**Possible but unlikely or remote chance of occurrence**
Unlikely	**E**	**Not expected to occur in career/equipment service life**

Figure 2. Hazard Frequency Categories – After Ref. [54].

Using the Army Safety Office's Hazard Frequency Category (Figure 2), the hazard frequency, or degree of risk, is determined to be either seldom or unlikely. The seldom category relates to a possible but unlikely occurrence. The unlikely category relates to an

occurrence that is not expected. Since there has been no theft attempts in 36 years of MRI's experience with chemical agents, a theft attempt could be considered as unlikely. However, it can be argued that even though there has never been a theft attempt, a theft attempt is still possible.

e. Management of Risks

Now that the risk of potential chemical agent theft attempts has been categorized, the next question is who has the authority to accept this risk. The Center has established a decision authority matrix based on Department of the Army Safety Office guidance. The decision authority matrix is provided as a combination of Figure 3 and Table 17.

The decision authority matrix is a tool used for the risk decision making process for a chemical agent operation. After the hazard probability (frequency of occurrence) and hazard severity (consequence of occurrence) are determined, the risk assessment matrix (Figure 3) is used to predict the risks. After predicting the risk of the chemical agent operation, the Risk Decision Authority (Table 17) is established. The chemical agent operation is not performed until the proper authority approves the risk.

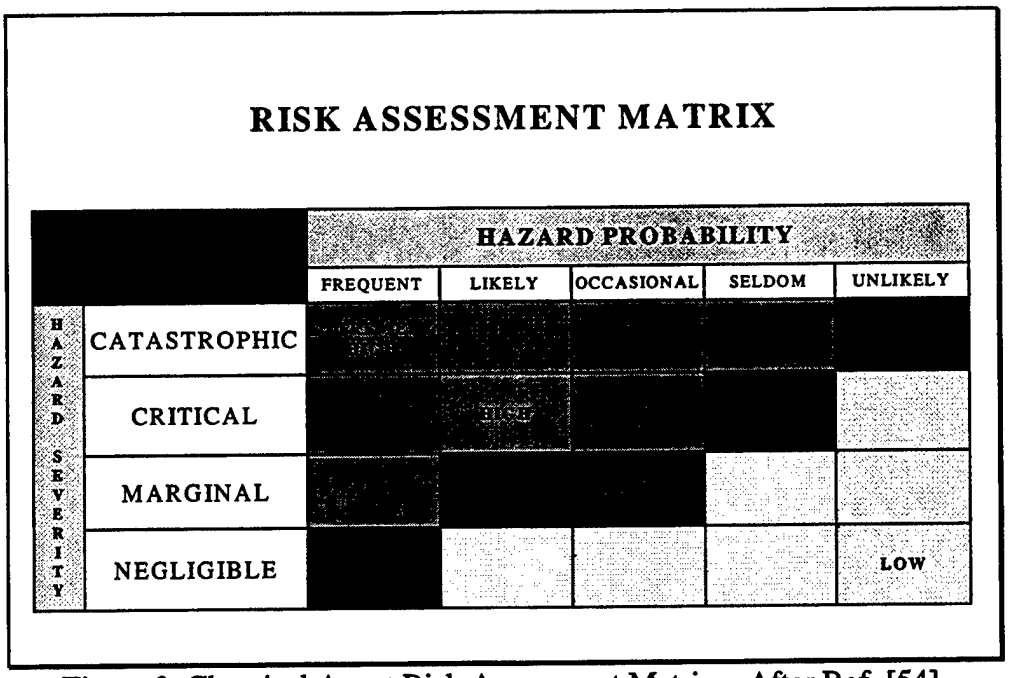

Figure 3. Chemical Agent Risk Assessment Matrix – After Ref. [54].

Looking at the risk assessment matrix blocks where the hazard probability (degree of risk) categories of Seldom and Unlikely and the hazard severity (harm) categories of Critical and Catastrophic intersect, the risk ranges from low to high. The low risk is located at the Critical and Unlikely matrix intersection. The high risk is located at the Catastrophic and Seldom matrix intersection. The other two combinations, located at the Critical/Seldom and Catastrophic/Unlikely intersections, are medium risks.

f. Decision Authority

The Center, which provides the majority of the chemical agent research for the Army and DOD, has established a level of decision authority to compliment the Risk Assessment Matrix (Figure 3). This level of decision authority is in consonance with the Army Safety Office guidance. The Army Safety Office's level of decision authority to waive chemical agent procedures and processes is found in Table 17. [Ref. 54]

Risk Level	Waiver Decision Authority
Extremely High	Commanding General of the Army Materiel Command
High	Commanding General of the Soldier, Biological and Chemical Command
Medium	Technical Director, Edgewood Chemical and Biological Center
Low	Technical Director, Edgewood Chemical and Biological Center

Table 17. Risk Decision Authority.

From these levels of decision authority, the Technical Director of the Edgewood Chemical and Biological Center assumes both low and medium risks for chemical agent operations. The Commanding General of the Soldier, Biological and Chemical Command (SBCCOM) assumes high risks for chemical agent operations.

The Army Safety Office has established prudent management of risk guidelines. The Center has implemented these guidelines with the Decision Authority Matrix. However, a similar matrix does not exist for chemical agent security. The Army's physical security proponents work for ODCSOPS. Although the risks can be equally catastrophic for an operational accident and a security incident, the Army's ODCSOPS does not allow the assumption of security risks by Commanding Generals. The Secretary of the Army's appointment of SBCCOM (previously CBDCOM) as a reinvention laboratory gave the Commanding General the assumption of risk authority.

When the Commanding General (CG) of the Chemical and Biological Defense Command (now SBCCOM) received reinvention waiver authority from the Secretary of the Army, his first reinvention waivers substituted Army regulations for contractor chemical agent laboratory physical security, personnel reliability and safety with the

Guidebook of Performance Standards. These reinvention waivers would not have been necessary had there been a similar Decision Authority Matrix for physical security and personnel reliability.

g. Protective Measures to Minimize Potential Harm

The Guidebook of Performance Standards requires protective measures that minimize potential harm. These include:

- Threat and Vulnerability Assessments
- Chemical Agent Accountability
- Secure Storage Requirements
- Room and Laboratory Construction Requirements
- Intrusion Detections Systems with Emergency Power Back-Up
- Entry/Access Controls to Laboratories
- Security Response Force Requirements
- Security Incident Reporting Requirements [Ref. 26]

According to MRI personnel, there was no reduction in physical security protective measures as a result of converting from Army regulations to commercial performance standards [Ref. 6]. Therefore, protective measures to minimize the harm associated with the risk of theft, sabotage or unauthorized use of chemical agents are in place with the Guidebook of Performance standards.

C. SUMMARY

The cost-benefit analysis shows that the benefits of converting from Army regulations to commercial performance standards at MRI far exceed their costs of conversion using both discount rates of eight and fifteen percents. There are additional benefits of using the Guidebook of Performance Standards, such as having 70 pages of guidance instead of 600 pages of guidance, which are not included in the benefit measurements.

The risk to the Army of using the Guidebook of Performance Standards includes the possibility of theft, sabotage or unauthorized use of chemical agents at MRI laboratories [Ref. 34]. In 36 years of operation, there has never been a theft, theft attempt, sabotage or unauthorized use of chemical agents at MRI [Ref. 53]. This flawless record includes about ten years of operation under Army regulations and 26 years of operation under less detailed guidance. However, if a theft occurs, the consequences can be critical or catastrophic.

The Army's Safety Office gives decision authority guidance that enables the leaders of Army organizations to assume risks. Using the Decision Authority Matrix from the Edgewood Chemical and Biological Center, the appropriate decision making level for assuming risks for a chemical agent operation is the Commanding General of the Soldier, Biological and Chemical Command. A similar Decision Making Matrix for Army physical security waivers does not exist. Therefore, Major General Friel assumed the risk of theft of chemical agent at MRI when he used his reinvention authority to waive the current Army regulations.

Now that cost-benefit and risk analyses are complete, the next chapter provides conclusions, recommendations for further improvements to the Guidebook of Performance Standards and recommendations for further study.

V. CONCLUSIONS AND RECOMMENDATIONS

In this chapter, conclusions are drawn from the research in regards to the costs, benefits and risks of converting from Army regulations to commercial performance standards at Midwest Reseach Institutes chemical agent laboratories. Recommendations are offered relating to necessary measurements during the transition from military specifications to commercial performance standards and continuous improvement of the Guidebook. Lessons learned during the conversion process are provided to inform other managers interested in converting to performance standards, and areas for further research are proposed.

A. CONCLUSIONS

1. Costs

The transition from Army regulations to commercial performance standards cost MRI an estimated $22,700. The transition costs include both direct labor costs and opportunity costs. The opportunity costs include overhead, general and administrative expense and profit that were foregone while MRI employees worked on internal plans, procedures and training. MRI's transition costs were not substantial, but should have been measured as a part of the reinvention effort to replace Army regulations with commercial performance standards. Transition costs should not be ignored for any reinvention effort.

Research of other agencies, within the Departments of Defense and Energy, uncovered a pattern of not requiring the measurement of transition costs of converting to commercial performance standards. The Department of the Army's Redstone Arsenal has replaced many military specifications with commercial performance standards. At some point, contractors are required to use the commercial performance standards instead of military specifications. If a contractor has never used military specifications, then there are no transition costs to use the commercial performance standard. However, if a contractor has used military specifications for any period of time, a new contract, with new commercial performance standards, requires the contractor to rewrite plans and procedures. The Department of Defense needs to be aware of these costs.

2. Benefits

a. Government Benefits

Benefits, which reduce MRI contract costs to the government, are procedural. These benefits, which relate to operational efficiency, include:

- Maintenance procedures for intrusion detection systems (IDS)
- Entry control procedures for laboratory entrance
- Administrative procedures for the personnel reliability program (PRP)

The benefits of these procedural changes are small – only $12,269 for the first year operating under commercial performance standards. However, in less than two years, the benefits exceeded the costs for MRI's portion of the government's contract effort to write the Guidebook of Performance Standards. This pay back period is based on discount rates of both eight and fifteen percent. The government contract costs were not factored into

the original costs of transitioning from Army regulations to commercial performance standards. In the future, these costs should be considered.

b. MRI Benefits

MRI benefits are substantial and based on the assumption that if scientists are not available to work on government chemical agent contracts, then MRI either has to extend those contracts (and postpones direct labor, overhead, G&A and profits) or has to subcontract the efforts to complete the contracts (and foregoes direct labor, overhead, G&A and profits). In either case, MRI is less effective in completing chemical agent research contracts for their customers.

Over and above the cost benefits to MRI are significant qualitative benefits. These benefits include:

- One commercial reference using performance language instead of six or more military references using military unique language
- Allowing enough scientific freedom to enable keeping better people in the system

Although these benefits are not quantifiable, they give MRI additional operating flexibility and decrease the time to interpret guidance. Qualitative benefits should be a part of any cost-benefit analysis related to implementing commercial performance standards.

3. Risks

There are both business risks to MRI and national security risks to the Army when Army regulations are replaced with commercial performance standards at commercial laboratories performing research with chemical agents. The business risks to MRI include:

- It is easier for other commercial laboratories to get into the chemical agent research business
- If something goes wrong, the contractor will most likely be blamed
- There is potential for misinterpretation by the contractor and Army
- Do not know how the program will be administered
- The supporters of the new standard will move on

The national security risks to the Army include:

- Lethal characteristics of the Army warrant extraordinary security measures
- Chemical agents are inherently dangerous and possible targets for theft, sabotage and unauthorized use
- Commercial standards generalize security standards and fail to provide detailed guidance
- Recent world events lend credence to chemical agent lethal threats
- Intelligence gathering have identified a terrorist organization that is attempting to gain chemical agents

Risks to replace military specifications and detailed guidance with commercial performance standards need to be managed. There are risks (e.g., costs, security, interpretation) involved in any transition from military specifications to commercial performance standards. These risks need to be gathered and analyzed. There needs to be a plan in place that defines the level of authority to which risks are identified for approval. Risks must be defined, discussed, reduced if possible and then assumed by the proper level of authority. NASA's Risk Assessment Methodology is an excellent tool to analyze and establish acceptable levels of risks [Ref. 50].

B. RECOMMENDATIONS

1. Government Performance and Results Act of 1993

The purpose of the Government Performance and Results Act is:

> To shift the focus of government management from inputs to outputs and outcomes, from process to results, from compliance to performance, and from management control to management initiative. [Ref. 55]

In order to fulfill the purpose of the Government Performance and Results Act (GPRA), the basic requirements are:

> All agencies must define long-term goals, set annual performance targets derived from these goals, and annually compare actual performance to the targets. [Ref. 55]

The use of commercial performance standards instead of Army regulations meets the purpose of the GPRA. Moving from compliance and management control to performance and management initiative defines the reinvention effort of the Guidebook of Performance Standards. But the GPRA does not simply mandate the shift from compliance to performance. The GPRA also requires performance targets and measurements of actual performance.

The shift from military specifications and detail requirements to commercial performance standards must include measurements of the transition. Cost-benefit analysis is an excellent method of measurement. From the research, it does not appear that any measurements are required when military specifications are replaced with commercial performance standards. There is no mention of the costs associated with these transitions, whether the benefits exceed the costs and how long it may take for the benefits to exceed the costs. Transitioning from military specifications to commercial performance standards meets the purpose of the GPRA, but to fully meet the intent, actual performance measurements must be made.

The cost-benefit analysis of the transition from Army regulations to commercial performance standards at MRI shows a positive net present value at both eight and fifteen percent discount rates. The net present value is positive for both MRI and the government. Targets need to be set for further transition efforts. Payback periods and discount rates need to be established. Organizations need to be specific about targets and performance measurements prior to mass transitioning from military specifications to commercial performance standards.

Qualitative benefits of transitioning from military specifications to commercial performance standards are not normally quantified. However, some sort of metric can be designed to capture qualitative benefits. For the MRI case study, numbers of references and numbers of pages are quantifiable benefits. Going from more than 600 pages to less than 70 pages provides a performance metric for a qualitative measurement.

2. Continuous Improvement

The Guidebook of Performance Standards was approved in April 1996 and implemented in July 1996. At the May 1996 Contractor/Government Working Group Meeting, a subgroup was formed to address continuous improvement of the Guidebook. The plan was for the subgroup to meet after each Working Group Meeting to discuss detailed changes to the Guidebook in order to eliminate problems in interpretation. Problems in interpretation especially appear during contractor laboratory assessments by either the Center or the Department of the Army Inspector General.

The success of the implementation of the Guidebook has led to inadequate challenges of the requirements of the Guidebook. There is still much that needs to be improved. When the commercial performance standards were written for the Guidebook, portions of the Army regulation for physical security were placed within the performance standards. This borrowing from an Army regulation was a compromise between the writers of the standards and physical security organizations within the Army Materiel Command (AMC). The compromise allowed total support from the AMC Commanding General, General Wilson, and his staff.

The compromises for physical security were essential to gain approval from organizations within AMC. However, the final product of physical security requirements in the Guidebook still includes too much detail. Although the Department of the Army proponent has still not endorsed the Guidebook, improved physical security performance standards should be drafted, approved and implemented through the Contractor/Government Working Group.

C. LESSONS LEARNED

1. Performance Standards

The search for performance standards is not an easy task. The Army's Redstone Arsenal is spending man-years of effort in its quest to replace military specifications with commercial performance standards [Ref. 40]. The Edgewood Chemical and Biological Center's (ECBC) decision to use the Chemical and Biological Defense Information Analysis Center (CBIAC) was a wise decision.

Government agencies are not as cognizant of the existence of applicable commercial performance standards as are contractors who work with the standards. Battelle's management of the CBIAC allowed for quick research of applicable commercial performance standards that Battelle and other commercial laboratories (such as MRI) were already using. Through Battelle's research analysis, the ECBC was able to quickly discern which of the commercial standards would be the best fit with the current Army regulations.

2. Process of Conversion to Performance Standards

The process of converting from Army regulations to commercial performance standards was a success because it included all of the Army Materiel Command (AMC) and contractor laboratory stakeholders. All stakeholders were invited and all participated. Each of the contractor laboratories and pertinent AMC organizations participated in reviews and commented on draft documents during the conversion process. The CBIAC coordinated all of the comments. Several drafts of the Guidebook were staffed with each of the stakeholders. Hundreds of pages of comments were sifted through and incorporated into the final Guidebook.

During the process of writing the Guidebook, Contractor/Government Working Group Meetings lasted at least two days. Disagreements about language and content were thoroughly discussed. Each of the stakeholders had an opportunity to express its concerns and viewpoints. Meetings were not adjourned until all open items were either closed or assigned to an action officer. Often, the action officer was an employee of one of the

contractor laboratories. These contractor employees searched for other performance standards that were a better compromise. The efforts always led to a better Guidebook product.

3. Measurements of Conversion to Performance Standards

It is the intent of reinvention to have processes become more efficient. Therefore, metrics are normally designed to accentuate the benefits of process reinvention. When the reinvention waivers were originally submitted to Major General Friel for his approval, metrics were designed carefully to present positive benefits of change. A better, and still ultimately successful, design would have measured costs to each contractor to write new plans and procedures and train their employees to these new plans and procedures. Valuable information was therefore lost. In retrospect, the costs data requested from MRI for this research should have been a part of the metrics gathered during the conversion process.

Although it is natural to want only data that supports a decision, some data are essential to making decisions regarding efficiency. Complete cost data are essential - not just the costs of operating before an operation changes, but the costs to actually change the operation. Future reinvention measurements should include these costs of conversion. And these costs should be measured against the benefits of conversion. Cost-benefit analysis should become a means to support the success of reinvention efforts.

D. AREAS FOR FURTHER RESEARCH

1. ISO 9000 Series Requirements

In addition to transitioning from Army regulations to commercial performance standards, the Guidebook required MRI to conform to ISO 9000 quality standards or their AMC equivalent. The AMC equivalent to the ISO 9000 Series is the Contractor Performance Certification Program, which is also known as CP2. Though MRI is required to adhere to strict FDA and EPA quality standards, MRI had never been required to operate under DOD quality standards.

MRI opted to be certified under AMC's CP2 Program. The CP2 Program for contractor laboratories has all of the same requirements as ISO 9002. The only difference is that AMC provides the certification instead of an independent third party. Independent third party certifications for laboratories can cost between $5,000 and $10,000 depending on the third party certifier and the size of the laboratory being certified. MRI opted for the AMC certification because there is no charge from AMC for the certification.

The requirement for ISO 9000 or CP2 certification came from the Chemical and Biological Command's (CBDCOM) strategic plan. Major General Friel, Commander of CBDCOM, wanted all contractors performing services for CBDCOM to be ISO 9000 or CP2 certified. Therefore, all contractor laboratories performing research with chemical agents had to be certified. This included MRI.

MRI took nearly a year to write all of the plans and procedures required for CP2 certification. It went through several AMC audits during the process. Laboratory

workers were trained to new processes of documentation and documents had to be controlled like never before. It is possible that more hours were spent preparing for CP2 certification than transitioning to the commercial standards that replaced the Army requirements of the Guidebook.

The cost to implement CP2 at MRI was not of concern to CBDCOM. Its interest was the blanket certification of all contractors dealing with CBDCOM. Though this may have been a noble interest, it was also costly to MRI and all the other contractor laboratories.

The costs to MRI (or any other contractor) for CP2 (or ISO 9000) certification should be recorded as well as any benefits that accrue from the certification. This cost-benefit analysis would be an excellent research project. The research could also include the ethics of requiring all contractors to be certified to any commercial or government program as a result of command strategic planning or direction by a Commanding Officer.

2. Conversion to Performance Standards at Redstone Arsenal

The Army's Redstone Arsenal is spending man-years of effort converting military specifications to commercial performance standards. These efforts are briefly discussed in Chapter III. The benefit of these conversion efforts, according to the Redstone Arsenal point of contact, is less litigation to the Army. Redstone Arsenal has not documented any savings as a result of these extensive conversion efforts. A thorough cost-benefit analysis of the conversion to performance standards at Redstone Arsenal should be performed.

3. Local Records Checks versus National Agency Checks

One of the national security concerns of the Army is the inadequate amount of information received from local records checks compared to National Agency Checks (NACs). Companies can have local records checks performed by their local county sheriff's office or by firms that specialize in criminal, credit and education background checks at all local jurisdictions. MRI and most other chemical agent contractor laboratories use investigating firms to provide the local record checks on their employees.

The Army proponent for physical security argues that local records checks do not provide adequate information [Ref. 35]. The Army proponent further states that only NACs provide enough detailed information to decide whether an employee should be allowed access to chemical agents. Some members of the intelligence community argue that local records checks are superior to NACs in that they discover criminal activity at local precincts that are not recorded at the national level. There is obviously some comfort level with local records checks since they (and not NACs) are required for access to manportable missiles and rockets "in a ready to fire" configuration (e.g., Stinger missiles) [Ref. 32].

There needs to be an investigation as to the benefits of local records checks and National Agency Checks. Local records checks cost about $75 to $100 and take about 72 hours to complete. National Agency Checks take from three to six months to complete. Costs are not available. The investigation should look at the costs and benefits of these intelligence investigations. It should also include the possibility of outsourcing much of the intelligence gathering efforts that are not involved with individuals who require access

to classified information. With the advent of information technology, more intelligence information resides at local precinct levels than ever before.

APPENDIX A. MIDWEST RESEARCH INSTITUTE QUESTIONNAIRE

The following questionnaire was submitted to MRI in November 1998. It is the principal research instrument. MRI's responses to this questionnaire are used throughout this research.

I. History
   - A. Please give brief summary of the history of MRI, to include date of incorporation, original mission, original staffing and first Department of Defense (DOD) contract.
   - B. When did you begin your mission of research, development, test and evaluation (RDT&E) using chemical agents?
   - C. When did you begin your mission of RDT&E using biological toxins?
   - D. When did you begin your mission of RDT&E using controlled substances?
   - E. How long have you been operating under DOD Regulations (any Service) while performing chemical agent RDT&E?
   - F. How long have you been operating under Army Regulations while performing chemical agent RDT&E?
   - G. How long have you been operating with a personnel reliability program (PRP)?
   - H. How long have you been operating with an intrusion detection system (IDS)?
   - I. How long have you been operating with entry and package control procedures?
   - J. How long have you operated a drug-testing program for the corporation? For the PRP? Is there a corporate drug testing policy?

II. Regulations
   - A. Under which government regulations and standards does MRI operate?
   - B. Under which commercial standards (i.e. ISO 9000) does MRI operate?

III. MRI Staff
   - A. How many MRI personnel are involved in chemical agent RDT&E (administrative, technical, professional, managerial)?
   - B. How many MRI personnel are in the PRP?
   - C. How many of PRP are only involved in emergency response?
   - D. How many of PRP have daily access to chemical agent?
   - E. What is the educational profile of those PRP employees who have daily access to chemical agent?

F. What is the percent of PRP employees who have daily access to chemical agent who are local residents (within 50 miles of MRI)?

IV. Threat Assessment
- A. Who provides the threat assessment for MRI?
- B. Is there a current threat?
- C. How often does MRI meet with/discuss threat assessment and with whom?
- D. Does MRI have direct access to threat information or must they go through the Army Contracting Officer? Explain process.

V. Emergency Response
- A. Safety
  1. Over the past decade, how many actual chemical incidents (safety accidents related to chemical agent) have occurred?
     - a. Lost time due to these incidents?
     - b. Laboratory/facility damage due to these incidents?
     - c. Operation downtime due to these incidents?
  2. How often do you exercise your emergency response process?
  3. What is the average time of response?
  4. With whom do you have medical agreements (hospital/clinic) and how often are those agreements updated?
  5. Are medical support personnel trained? If so, by whom?
  6. Is the local fire department trained? If so, by whom?
  7. As a result of conversion from Army Regulations to Commercial Performance Standards, were there any changes to these procedures/processes (to include outside medical and fire department support)?
- B. Security
  1. Since you have worked with chemical agents, have you ever had a security incident?
  2. If an incident occurred, what was the result? Anyone exposed? Any actual theft? Who responded? How quickly?
  3. With whom do you have security response agreements and how often are these agreements updated?
  4. How often do you exercise your physical security emergency response process?
  5. What is the average time of response?
  6. Are security response personnel trained? If so, by whom?
  7. As a result of conversion from Army Regulations to Commercial Performance Standards, were there any changes to these procedures/processes (to include police support)?

VI. Costs of conversion
- A. As a result of the reinvention effort, how many hours were spent in converting from the Safety Plan specified in the Army Regulations to the

Chemical Hygiene Plan specified in the Guidebook of Performance Standards?

1. Percent of hours for administrative personnel?
2. Percent of hours for technical personnel?
3. Percent of hours for professional personnel?
4. Percent of hours for managerial personnel?

B. As a result of the reinvention effort, how many hours were spent in converting from the physical security plan specified in the Army Regulations to the physical security requirements specified in the Guidebook of Performance Standards?

1. Percent of hours for administrative personnel?
2. Percent of hours for technical personnel?
3. Percent of hours for professional personnel?
4. Percent of hours for managerial personnel?

C. As a result of the reinvention effort, how many hours were spent in converting from the personnel reliability plan specified in the Army Regulations to the personnel reliability requirements specified in the Guidebook of Performance Standards?

1. Percent of hours for administrative personnel?
2. Percent hours for technical personnel?
3. Percent hours for professional personnel?
4. Percent hours for managerial personnel?

D. Please specify any additional hours spent in the conversion process and by what level of individual (meetings, briefings, comments to Guidebook).

E. Please give general comments concerning costs of the conversion process.

F. Please give general comments concerning costs of the continuous improvement process after the initial conversion.

VII. Benefits

A. Safety

1. What reduction in effort has occurred as a result of the conversion process?

   a. Administrative
   b. Technical
   c. Professional
   d. Managerial

2. Other than hours of savings, are there any other benefits to using the chemical hygiene plan of the Guidebook instead of the safety plan of the Army Regulations? If so, please specify.

B. Physical Security

1. What reduction in effort has occurred as a result of the conversion process?

a. Administrative
b. Technical
c. Professional
d. Managerial

2. Other than hours of savings, are there any other benefits to using the physical security plan of the Guidebook instead of the physical security plan of the Army Regulations? If so, please specify?

C. Personnel Reliability

1. What reduction in effort has occurred as a result of the conversion process?

a. Administrative
b. Technical
c. Professional
d. Managerial

2. Other than hours of savings, are there any other benefits to using the personnel reliability plan of the Guidebook instead of the personnel reliability plan of the Army Regulations? If so, please specify?

D. Oversight

1. What reduction in effort has occurred as a result of reducing oversight visits from once every nine months to once every year?
   a. Administrative
   b. Technical
   c. Professional
   d. Managerial
2. Other than hours saved, are there any other benefits to the reduced oversight schedule?

VIII. Risks

A. What is senior management's assessment of the risks involved in converting the following processes?
   1. Safety
   2. Physical security
   3. Personnel reliability
   4. Oversight

B. Would the risks change if the Army required MRI to go back to the Army Regulations? If so, how would they change?

APPENDIX B. ARMY EMPLOYEE DISQUALIFICATION STANDARDS

The following Army disqualification standards are taken from Army Regulation AR 50-6 [Ref.56]. These standards apply to any employee (Army or contractor) who has access to chemical weapons or research quantities of chemical agent.

2.11.B Disqualifying factors.

b. Disqualifying factors. Any of the following traits, diagnoses, conditions, or conduct will normally (except as noted in b(1)(d), (e), (f) and b(2)(b) and (f) below) be considered disqualifying for the chemical PRP unless overriding evidence of reliable duty performance exists. The list is not all encompassing and contains only examples of disqualifying factors.

(1) Alcohol Incidents, Dependence, or Abuse.

(a) Alcohol incidents involving irresponsible use of alcoholic beverage leading to misconduct, unacceptable social behavior, impairment of an individual's performance of duty, adverse health impacts, or financial irresponsibility may be grounds for disqualification action.

(b) Individuals (military or civilian) involved in alcohol incidents shall be either medically restricted or temporarily disqualified from the PRP, as appropriate, and referred for Alcohol and Drug Abuse Prevention and Control Program (ADAPCP) evaluation (see AR 600-85). The ADAPCP evaluation will be completed within four working days from the date of referral. Upon receipt of the ADAPCP evaluation, the certifying official must either initiate permanent disqualification action or restore the individual to assigned PRP duties, as appropriate--

(c) Determination of alcohol dependence or abuse will be made by competent medical authority as identified in paragraph2-15a (1).

(d) Individuals (military or civilian) diagnosed as alcohol dependent shall be permanently disqualified from the PRP. These individuals may request to be considered for PRP requalification after successfully completing a rehabilitation program prescribed by competent medical authority identified in paragraph 2-15a(1). A PRP qualification screening, including a complete medical evaluation with a favorable prognosis by the competent medical authority, will be completed before requesting requalification.

(e) Individuals (military or civilian) diagnosed as alcohol abusers will, as a minimum, be temporarily disqualified from the PRP. These individuals may be reinstated into the PRP after successfully completing a minimum of 90 days of a rehabilitation program prescribed by competent medical authority identified in paragraph 2-15a(1) and receiving a favorable prognosis by competent medical authority.

(f) When contractor employees are not authorized participation in the Army ADAPCP, private accredited alcohol abuse counseling and treatment services provided by the employer may satisfy the above requirements.

(2) Drug Abuse.

(a) Drug abuse is the use or possession of controlled substances, illegal drugs, or the non-medical or improper use of other drugs (e.g. prescription, over the counter, etc.) that are packaged with a recommended safe dosage.

(b) It is not the intent of this regulation to automatically render ineligible for the PRP any individual who, before the effective date of this regulation, has disclosed pre-Service drug abuse, or who has not yet been asked to make such disclosure, and is currently certified for PRP duties after having been formally screened in accordance with previous existing policy and guidance. Further certification of such individuals for future PRP status will be according to this regulation, except that previously disclosed and considered drug abuse and pre-Service drug use not required previously to be disclosed, will not be the sole grounds for denial of certification or for mandatory disqualification.

(c) Except for the category of individuals identified in subparagraph 2-11b(2)(b) above or otherwise provided in this regulation, any use, admitted or otherwise discovered, of illicit drugs such as heroin, heroin derivatives, cocaine, " crack," PCP, LSD, "ecstasy," or other "designer" drugs, amphetamines, barbiturates, anabolic steroids, and other narcotic drugs not prescribed by proper medical authorities, will render an individual ineligible for admission to or retention in PRP duties. Such individuals will not be certified into the program and will be permanently disqualified. These actions will be made a matter of permanent record.

(d) Any individual found to have been involved in unauthorized trafficking, cultivation, processing, manufacturing, or sale of any narcotic or dangerous drug such as those mentioned above, or marijuana or cannabis-based products, will be ineligible for PRP duties.

(e) Any individual suspected of using illegal drugs while in the PRP will be either medically restricted or temporarily disqualified as appropriate and referred for an ADAPCP evaluation. The ADAPCP evaluation will be completed within four working days from the date of the referral. Upon receipt of the ADAPCP evaluation, the certifying official will either initiate permanent disqualification action or reinstated into the PRP as appropriate.

(f) Pre-service experimental or infrequent use of cannabis products does not necessarily render an individual ineligible for consideration for or retention in a PRP position. An individual that (having disclosed pre-Service experimentation or infrequent use of marijuana, hashish, or other cannabis-based products) was certified into the PRP may be retained in the program if medical evaluation conducted by competent medical authority establishes no cannabis dependency and there is no additional information that would cause the certifying official to doubt the individual's reliability. It is incumbent on the certifying official to determine the degree to which the pre-Service use affects the reliability of the individual being considered. Individuals determined to be ineligible for retention in the PRP will be permanently disqualified; such action will be made a matter of permanent record.

(g) According to para 10-3, AR 600-85, all military personnel performing PRP duties must undergo urine drug testing a minimum of once per year. DOD civilians working in, or tentatively selected for Testing Designated Positions (TDP), will be required to be tested prior to being certified into the PRP (para R600-85 5-14). After certification into the PRP, civilians will be tested periodically on a random basis that ensures the deterrence value of the testing. See chapter 8 for drug testing requirements for contractor employees performing PRP duties. Physicians acting as medical review officers for civilian urine drug testing programs will not contact certifying officials with positive urine drug screening results as evidence of potentially disqualifying drug abuse until the employee has been allowed the opportunity to document the use of prescription drugs and discuss the test results with the physician. Upon verifying the positive urine drug test result as evidence of unauthorized use, the physician will notify the certifying official. If the physician determines that the positive urine drug test is the result of authorized use of prescription drugs, however, the certifying official will not be notified. The physician should counsel the individual to promptly report the use of any prescription medication to the certifying official (see AR 600-85).

(3) Negligence or Delinquency in Performance of Duty. Because a good indication of reliability is past performance, the certifying official will review the PRP candidate's job or duty history for evidence of desirable traits such as dependability, flexibility, and good judgment. In determining reliability, the certifying official must evaluate all aspects of an individual's actions. For example, clear instances of youthful indiscretion are not necessarily proof of negligence or unreliability.

(4) Conviction of, or Involvement in, a Serious Incident. A PRP candidate's background will be reviewed for evidence of conviction by a military or civil court of a serious offense or a pattern of behavior or actions that is reasonably indicative of a contemptuous attitude toward the law or other duly constituted authority. Serious incidents include, but are not limited to: misdemeanor offenses, assault, sexual misconduct, financial irresponsibility, an inordinate number of traffic offenses, sexual harassment, and child or spouse abuse.

(5) Medical Condition. Any significant mental or physical medical condition substantiated by competent medical authority or aberrant behavior considered by the certifying official to be prejudicial to reliable performance of PRP duties may be considered as grounds for permanent disqualification from the PRP.

(6) Serious Progressive Illnesses. Certifying officials will be notified immediately of any individual being considered for or currently performing in a PRP position who has been diagnosed with a serious progressive illness, to include being diagnosed with Acquired-Immune Deficiency Syndrome (AIDS) or testing positive for the Human Immunodeficiency Virus (HIV). The certifying official will take the necessary actions to ensure that the individual is properly screened both medically and psychologically. However, individuals with AIDS or who are HIV positive will not be treated differently than other individuals with other serious progressive illnesses solely on the basis of being diagnosed with AIDS or testing HIV positive. As with all potentially disqualifying medical conditions, the certifying official must decide each case on the specific medical and other pertinent evaluations of the individual involved. The primary consideration in all determinations must be that of personnel reliability.

(7) Poor Attitude or Lack of Motivation. Any display of poor attitude or lack of motivation as evidenced by aberrant attitude, behavior, or mood.

(8) Inability to wear personal protective equipment (PPE) required by the assigned position. [Ref. 56]

APPENDIX C. GUIDEBOOK DISQUALIFICATION STANDARDS

The following are the Guidebook of Performance Standards requirements for drug testing and employee disqualification from work with chemical agents at contractor laboratories.

Preplacement Screening. The pre-placement screening and evaluation of candidates for the contractor ERP will include:

The initiation of the Contractor Freedom of Information Disclosure Statement.

A medical examination and evaluation including drug screening and documented ability to wear required safety apparel. [Ref. 26]

Disqualifying Factors. The following factors shall disqualify individuals from participation in the ERP:

1. Felony convictions within the past 5 years

2. Misdemeanors within the last 2 years

3. Current formal charges for any criminal offense

Disqualifying Considerations. The following factors shall be considered and may be the basis for disqualification from participation in the ERP:

1. Use of narcotics, amphetamines, or barbiturates not prescribed by a physician within the past 3 years

2. Involvement in unauthorized trafficking, cultivation, processing, manufacturing, or sale of any narcotic or illicit drug (including marijuana or cannabis-based products)

3. Alcohol abuse

4. Inability to wear protective clothing and equipment [Ref. 26]

APPENDIX D. ARMY VULNERABILITY ASSESSMENT STANDARDS

The following Army requirements for vulnerability assessments at contractor facilities are taken from Army Regulation AR 190-59 (Military Police Chemical Agent Security Program) [Ref. 57]. Chapter 14 of AR 190-59 delineates the physical security requirements for contracts and agreements for chemical agent research at off post locations (contractor laboratories). Chapter 14 references the requirements of Chapter 16 (Conduct of Vulnerability Assessments and Documentation).

Chapter 14

Security Provisions for Contracts and Agreements Involving Category III RDTE Chemical Agents at Off-post Locations

14-1 Category III RDTE Chemical Agents

a. The security provisions of this chapter shall apply to contractual arrangements or other agreements involving the authorized transfer of custody of category III RDTE chemical agents to another Government department or agency or to the private sector for use or storage at off-post locations.

14-3 Vulnerability Assessment

a. A vulnerability assessment shall be prepared in writing for facilities where chemical agents are stored or used. The assessment shall be accomplished by a team consisting of the facility manager, knowledgeable members of the facility security force, or local law enforcement officials, when applicable, and Government security specialists.

b. The DOD postulated security threat to chemical shall be provided to the contractor by the Government. The contractor shall use the postulated threat and local threat in conjunction with the facility vulnerability assessment.

c. Vulnerability assessments shall be conducted according to requirements in chapter 16 of this regulation. The vulnerability may be conformed to the physical layout and surrounding environment of the facility. A copy of this regulation shall be provided to the contractor by the Government.

d. The vulnerability assessment shall contain the actions taken to counter vulnerabilities identified during the assessment. The contractor shall use the standardized format in chapter 16 of this regulation, to document the results of the vulnerability assessment.

CHAPTER 16

Conduct of Vulnerability Assessments and Documentation

16-1 All Categories of Chemical Agents

a. The provisions of this chapter apply to all categories of chemical agents, regardless of location.

b. The vulnerability assessment (VA) will be conducted at each chemical agent storage facility to-

(1) Determine the facility's vulnerability to sabotage, theft, loss, seizure, or unauthorized access, use, or diversion of chemical agents from both external and internal threats.

(2) Counter the identified vulnerabilities.

16-2 DOD Postulated and Local Security Threats

The DOD postulated security threat and sensitivity factors for chemical agents in chapter 3 will be used as the basis for determining the facility's vulnerability to external and internal threats.

16-3 Risks and Threats

The risks and threats to chemical agents in paragraph 2-2 will be considered in establishing priorities for countering identified vulnerabilities.

16-4 Initial Completion Date

VAs will be conducted and completed within 180 days of the date of publication of this regulation. However, the VAs used to evaluate new waivers or exceptions. Or changes to existing security force requirements will be conducted and completed according to the new requirements in this chapter.

16-5 Reviews and Updates

a. The VAs will be reviewed yearly, or more frequent as new vulnerabilities become apparent. The conduct of a new VA is not required to meet this requirement. Documentation showing the formal review and corrective actions taken, if appropriate, is acceptable.

b. Specific actions to eliminate or reduce identified vulnerabilities will be documented.

16-6 Documentation Submission Requirements

Immediately upon completion (as required in para 16-4 and 16-5), the VAs, formal reviews, and updates will be documented and forwarded through command channels to ATTN DAMO-ODL, DEPUTY CHIEF OF STAFF FOR OPERATIONS AND PLANS, 400 ARMY PENTAGON, WASHINGTON DC 20310-400. To ensure uniformity in

complying with these requirements, the Major Commands (MACOMs) will establish procedures to --

a. Ensure chemical activities complete the required VAs, updates and annual reviews in a timely manner.

b. Ensure timely submission of completed VAs, updates and reviews through command channels to HQDA (DAMO-ODL).

16-7 VA Team Composition

a. The VA will be accomplished by a team consisting of the following personnel-

(1) Site or activity commander, or representative (commander's participation is encouraged, but is not required).

(2) Site and installation security officers.

(3) Knowledgeable members of the site and installation security forces, to include intelligence representative.

(4) Safety and health physics representatives.

b. When available, the VA team will also include the following personnel to provide technical and professional assistance in their areas of expertise from an off-post perspective:

(1) Security specialists from the headquarters of major subordinate commands or MACOMs.

(2) Other security specialists from outside the span of control of the site commander.

(3) Special Forces personnel.

(4) Corps of Engineers protective design specialists.

c. The team leader will be designated by the commander concerned. The completed VA documentation will be coordinated by all members of the team.

16-8 Guidance for Conducting Vas

a. The VA team members will be briefed on the purpose of the VA and threats to chemical agents.

b. Detailed briefings will be provided on the storage facility being assessed and results of applicable force-on-force exercises.

c . Facility defense plans and all pertinent SOPs will be reviewed.

d. Functional schematics and engineering drawings of the facility equipment and structures will be reviewed.

e. The VA team will identify the following-

(1) Specific areas that contain security interests.

(2) Target items in each area.

(3) Potential advisory acts for each target

f. The VA team will tour the facility and surrounding area to become knowledgeable of the site configuration, terrain, storage structures, security forces and technical operational activities at the facility. During the tour the team will identify specific vulnerabilities from external and internal threats. The team will-

(1) Observe day and night operations.

(2) Interview personnel as appropriate.

(3) Have equipment and procedures demonstrated.

(4) Note how the security forces are utilized, to include security forces and back-up forces.

(5) Ask "what-if" questions with reference to the possibility of covert or overt acts by insiders. Concentrate on means to bypass, subvert, overwhelm, or interrupt elements in the security system or two-person rule.

(6) As part of the terrain walk around the facility, note the logical avenues of approach, areas providing concealment, fields of fire into the facility, and probable strong points for attackers.

g. After the physical and operational layout of the facility is well known and the maps or sketches have been drawn and annotated, team personnel should mentally place themselves in the role of both the overt and covert attacker and war-game the attacks.

h. Plausible scenarios will be developed and documented for each target (para 16-8*e*). Consider the vulnerabilities noted and stated threats (para 16-2). The chance of success is evaluated by identifying the easiest way to attack the target. More than one scenario may be applicable. Each scenario will be developed using a two-party, adversary and defender, gaming approach. Together, the two parties choose credible paths and actions for the adversaries as well as plausible responses by the security system.

i. Based on the details of each of the resulting scenarios and the expected actions of both sides, the probability of the adversary defeat will be estimated by the team.

j. After documenting the scenario, the team should go back out on the ground, walk through, and possibly develop additional scenarios, or refine those already identified.

k. Conclusions and recommendations will be developed and documented by the VA team (follow security classification guidance in AR 380-86). The documentation will identify the vulnerabilities found and recommend specific actions to eliminate or reduce the vulnerabilities. The following requirements apply-

(1) Conclusions will express results that follow logically from the VA.

(2) Recommendations will support conclusions.

(3) Recommendations will be designed to reduce scenario likelihoods of success.

16-9 Command Decisions on Conclusions and Recommendations

a. The commander concerned will make a final decision on the conclusions and recommendations made by the VA team. Each identified vulnerability and recommended corrective actions will be addressed.

b. The VA documentation will be forwarded through command channels according to requirements in paragraph 16-6.

c. Each commander in the chain of command will review and endorse the VA documentation to ensure that appropriate corrective actions have been initiated or accomplished.

(1) At the major subordinate command level, this requirement may be performed by the Deputy Commander or Chief of Staff.

(2) At the HQ MACOM level (and the Surgeon General), this requirement may be performed by a general officer (or equivalent Senior Executive Service civilian) assigned to the MACOM headquarters staff element assigned responsibility for physical security matters.

16-10 Annotated Outline for VA Documentation

a. Introduction

(1) *Purpose* (Describe what this VA is being used for and how it is being applied).

(2) *Scope* (Describe what facilities are and are not included in this VA).

(3) *Site Description* (Give brief description of the site and included maps of the site and surrounding area. Include photographs when available).

(4) *Site Mission* (Give a brief description of the site mission).

(5) *Security Interests* (Identify specific areas that contain security interests and address any security interests that were not considered and why).

b. Identification and description of potential threats (Address what specific threats apply to this site according to guidance in paragraph 16-2). Be specific; do not just reference existing guidance. Specify likely threat objectives; threat tactics; and tools, explosives, and weapons that the threat could use in execution of their attack. Describe what threats were considered and eliminated and why they were eliminated). Cover-

(1) Insider adversaries.

(2) Outsider (external) adversaries.

(3) Insider or outsider collusion.

(4) Airborne attack or penetration

c. Characterization of security systems (Describe the physical protection, access control, and multi-element protection measures in place to protect target locations from the treat spectrum. Characterization should be specific to all protection in place relative to facility targets, exclusion and limited areas).

d. Target identification (Identify target items in each area. Describe potential adversary acts for each target, for example, sabotage, theft, seizure, unauthorized access, use, or diversion).

e. Identified vulnerabilities (Describe the specific vulnerabilities identified during the VA or each target).

f. Scenarios developed (Describe in detail the plausible scenarios that were developed for each target for the specific threat spectrums).

(1) Describe what performance tests were conducted to evaluate the facility and site security systems.

(2) Provide a recapitulation of security systems probabilities, delay times for chemical storage structure barriers, adversary target task times, security force response times, and security force neutralization times.

g. Conclusions and recommendations (Set forth the conclusions and recommendations, which were developed during the VA. Conclusions will express results that follow logically from the VA. Commendations will support conclusions, and will be designed to reduce scenario likelihood of success for each identified vulnerability).

h. Team leader signature (Also show that VA documentation was coordinated by all team members).

i. Command decisions on conclusions and recommendations (Each identified vulnerability and recommended corrective action(s) will be addressed. Provide signed endorsements by each commander in the chain of command, as required in para 16-9). [Ref. 57]

APPENDIX E. GUIDEBOOK VULNERABILITY ASSESSMENT STANDARDS

The following are the Guidebook of Performance Standards requirements for a vulnerability assessment at a contractor laboratory.

> **Threat and Vulnerability.** An assessment of the threat and vulnerability of the facility to sabotage, terrorism or other unauthorized penetration or access shall be completed and documented. The assessment shall consider the location of the facility and the type and quantity of agent stored and used there. The assessment shall be based on the analysis and assessment of local Federal, State, county, and local law enforcement agencies. [Ref. 26]

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